THE MARINE REVIEW

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INTERNATIONAL MERCANTILE MARINE CO.

Although handicapped by a heavy increase in its operating expenses, due to increased cost of coal, supplies and labor and the cost of five serious strikes, the International Mercantile Marine Co. recorded in its report for the year ended Dec. 31, 1907, next to the largest volume of net earnings ever noted in its history. The increase in its operating expenses was in excess of $3,000,000, but its surplus for the year was $4,033,730, of which $4,000,000 was transferred to its depreciation fund, thereby augmenting this fund and its insurance reserve to more than $11,000,000. Its gross earnings were the largest ever recorded, reaching almost $40,000,000.

The company also reported that during 1907 it had made all payments on account of its new steamships, then being built, from its current funds as a result of which its item of "capital assets" in its balance sheet was increased without any addition to its debt. Its sinking fund retired $374,000 of first mortgage 5 per cent bonds out of the earnings of the American and Red Star lines in 1906, and there was deposited with the trustees for the further redemption of bonds $250,000 out of the earnings of 1907. The debenture bonds of the constituent companies, which are held by the public, also were reduced from $778,579 to $696,129.

Gross voyage earnings amounted to $38,253,588, compared with $35,931,412 for the previous year and miscellaneous earnings reached $1,013,000, compared with $1,227,800 for the preceding year, making total gross earnings of $39,266,588, compared with $37,159,212 for 1906. Operating and general expenses involved $32,242,542, compared with $29,155,178 for the previous year, leaving net earnings of $7,024,046, compared with $8,004,034 for 1906.

Excess premiums and interest credited to the company's insurance fund aggregated $441,661, compared with $791,959 for the preceding year, while the profit on bonds for the sinking fund amounted to $57,021, compared with $28,597 for the previous year, making a total of $498,682, compared with $820,556 which, added to the net earnings, made net profits of $7,522,728, compared with $8,824,590 for the previous year.

Interest and discount on bonds, interest on loans and advances and the English income tax involved $3,488,997, compared with $3,795,836 for the preceding year, leaving a surplus for the year of $4,033.731, compared with $5,028,754 for 1906. The total surplus reached $4,312,637, compared with $5,278,906 for 1906. The amount appropriated for the depreciation of the company's steamships involved $4,000,000, compared with $5,000,000 for the previous year, leaving a profit and loss surplus of $312,637, compared with $278,906 for 1906.

The company's consolidated general balance sheet, as of Dec. 31, 1907, showed total assets of $194,471,900, compared with $192,047,794 on Dec. 31, 1906, and $192.545,672 on Dec. 31, 1905. These total assets represented $173,011,332 in cost of properties; $13,012,058 in investments in other companies; $25,461 in cash with trustees; $892,196 in inventories; $2,556,153 in accounts receivable; $1,208,538 in bills receivable and loans; $12,906 in interest received and accrued; $425,505 in advances and current accounts; $155,525 in agency balances; $599,811 in marketable stocks and bonds; $557,623 in cash and $2,014,792 in deferred charges.

The liabilities included $51,730,971 in preferred stock; $49,931,735 in common stock; $1,697 in stocks of constituent companies outstanding; $72,684,130 in bonds and debentures; $707,671 in loans on mortgages; $539.256 in loans and bills payable; $3,449,581 in accounts payable; $211,316 in agency balances; $1,006,072 in interest accrued; $54,036 in the National line's current account; $395,053 in reserves; $2,095,454 in deferred credits; $1,000,000 in insurance fund; $10,352,291 in depreciation fund and $312,637 in surplus.

In his report to the stockholders, J. Bruce Ismay, president of the company, says that all the company's steamships and other property have been maintained in a high state of efficiency and that the cost of the steamships, together with the depreciation on all property other than steamships, has been charged to operating expenses. The building scheme, outlined in the company's 1906 report, is being actively carried out, and it is expected that the first new steamship of the St. Lawrence trade will be delivered early next year, and the second in June. Continuing, Mr. Ismay says:

"The new steamship for the Atlantic Transport New York-London service will, it is hoped, be in commission by the time the 1909 passenger season opens. One of the steamers building at Belfast will be named the Lapland, when launched on June 27. She will be allocated to the New York-Antwerp trade and take her place in the Red Star line service not later than November next. The development of this traffic has been so great that the steamer Gothic, built for the White Star line's Australasian trade, was transferred to the Red Star line and will be operated under the Belgian flag between New York and Antwerp. Steps are being taken to replace this steamer in the New Zea-

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land trade. When the building program of the company is completed, the number of steamers now in service, including the subsidiary lines, will be 132, with a total of 1,159,704 tons.

"The report states that the operating conditions of 1907 were unusually difficult, including five serious strikes, besides several minor ones. These were costly in themselves and caused a diversion of freight traffic from the company's lines. The trans-Atlantic passenger traffic, both east and west, showed a material improvement as compared with previous years, but rates were unsatisfactory. The general trade between Great Britain, Australia and New Zealand was much better than in the previous year, and the earnings of the steamers in that trade were therefore improved.

"This does not include the operations of the Leyland and National lines, in which the company has important holdings. These lines have made separate reports, showing profits for the year, £116,519 for the Leyland line and £10,460 for the National line.

"The wisdom of the transfer of the White Star mail service between New York and Liverpool to the channel trade between New York and Southampton has been proved by the satisfactory working of the new service, and the appreciation of the same shown by the traveling public.

"Owing to the higher price of coal and all other consumable articles, the expenses of operating show a great increase in all directions during 1907, as compared with previous year, and through unfortunate conditions it was impossible to make corresponding advances in the rate for passengers and freight."

At the annual meeting of the stockholders the retiring directors were re-elected. The directors will meet in the near future and re-elect the outgoing officers.

Omnibus Navigation Bill

The omnibus navigation bill, passed at the first session of the present congress, is given below: Owing to the situation created by John Sharp Williams' demand for a roll call on every bill it was necessary to consolidate a number of bills in an omnibus bill in order to secure their passage at this session. The bill, numbered H. R. 21,815, reads as follows:

Be it enacted by the senate and house of representatives of the United States of America in congress assembled, That section 2,792 of the revised statutes be, and is hereby, amended by adding thereto, 30 days after the passage of this act, the following:

"Any passenger vessel engaged tri-weekly or oftener in trade between ports of the United States and foreign ports shall be exempt from entrance and clearance fees and tonnage taxes while such service tri-weekly or oftener is maintained."

Section 2.—That section 4,438 of the revised statutes is hereby amended to read as follows 60 days after the passage of this act:

"Section 4438.—The boards of local inspectors shall license and classify the masters, chief mates, and second and third mates, if in charge of a watch, engineers, and pilots of all steam vessels, and the masters of sail vessels of over 700 gross tons, and all other vessels of over 100 gross tons carrying passengers for hire. It shall be unlawful to employ any person or for any person to serve as a master, chief mate, engineer, or pilot of any steamer or as master of any sail vessel of over 700 gross tons or of any other vessel of over 100 gross tons carrying passengers for hire who is not licensed by the inspectors; and anyone violating the section shall be liable to a penalty of $100 for each offense."

Section 3.—That section 4467 of the revised statutes is hereby amended to read as follows:

"Section 4467.—The master of every passenger steamer shall keep a correct count of all the passengers received and delivered from day to day, which count shall be open to the inspection of the inspectors and officers of the customs at all times, and the aggregate number of passengers shall be furnished to inspectors as often as called for: Provided, however, That a correct list of passengers received and delivered from day to day shall be kept, instead of a correct count, by the masters of seagoing passenger steamers in the coastwise trade and by the masters of passenger steamers on the great lakes on routes exceeding 300 miles: Provided further, That nothing herein shall affect existing laws relative to vessels running between this country and foreign ports."

Section 4.—That section 4468 of the revised statutes is hereby amended to read as follows:

"Section 4468.—Every master of any passenger steamer who fails, through negligence or design, to keep a count or list of passengers as required by the preceding section shall be liable to a penalty of $100."

Section 5.—That whenever it shall be made to appear to the satisfaction of the president of the United States that yachts belonging to any regularly organized yacht club of the United States are allowed to arrive at and depart from any foreign port and to cruise in the waters of such port without entering or clearing at the custom-house thereof and without the payment of any charges for entering or clearing, dues, duty per ton, tonnage taxes or charges for cruising licenses, the secretary of commerce and labor may authorize and direct the customs authorities at the various ports and subports of entry of the United States to allow yachts from such foreign port belonging to any regularly organized yacht club thereof to arrive at and depart from any port or subport of the United States and to cruise in waters of the United States without the payment of any charges for entering or clearing, dues, duty per ton, or tonnage taxes, but the secretary of commerce and labor may, in his discretion, direct that such foreign yachts shall be required to obtain licenses to cruise, in a form prescribed by him, before they shall be allowed under the provisions of this act to cruise in waters of the United States. Such licenses shall be issued without cost to such yachts and shall prescribe such limitations as to length of time, direction, and place of cruising and action, and such other particulars as the secretary of commerce and labor may deem proper: Provided, That the privileges of this section shall not extend to any yacht built outside of the United States and owned, chartered, or used by a citizen of the United States unless such ownership or charter was acquired prior to Feb. 5, 1907.

Section 6.—That section 4216 of the revised statutes is hereby repealed.

Section 7.—That 30 days after the passage of this act if a ship owner desires to use for the purpose of a private code any rockets, lights, or other similar signals, he may register those signals and house flags and funnel marks with the commissioner of navigation, who shall give public notice from time to time of the signals, house flags, and funnel marks so registered in such manner as he may think requisite for preventing those signals from being mistaken for signals of distress or signals for pilots. The commissioner of navigation may refuse to register any signals which in his opinion can not easily be distinguished from signals of distress, signals for pilots, or signals prescribed by laws for preventing collisions.

Section 8.—That section 3 of the act of Aug. 18, 1894, entitled "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," be, and the same hereby is, amended so as to read as follows, 60 days after the passage of this act:

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"Section 3.—That section 3 of the act to prevent obstructive and injurious deposits within the harbor and adjacent waters of New York City, by dumping or otherwise, and to punish and prevent such offenses, approved June 29, 1888, shall be, and hereby is, amended so as to read as follows:

"'Section 3.—That in all cases of receiving on board of any scows or boats such forbidden matter or substance as herein described, the owner or master, or person acting in such capacity on board of such scows or boats, before proceeding to take or tow the same to the place of deposit, shall apply for and obtain from the supervisor of the harbor appointed hereunder a permit defining the precise limits within which the discharge of such scows or boats may be made; and it shall not be lawful for the owner or master, or person acting in such capacity, of any tug or towboat to tow or move any scow or boat so loaded with such forbidden matter until such permit shall have been obtained; and every person violating the foregoing provisions of this section shall be deemed guilty of a misdemeanor, and on conviction thereof shall be punished by a fine of not more than $1,000 nor less than $500, and in addition thereto the the master of any tug or towboat so offending shall have his license revoked or suspended for a term to be fixed by the judge before whom tried and convicted.

"'And any deviation from such dumping or discharging place specified in such permit shall be a misdemeanor, and the owner and master, or person acting in the capacity of master, of any scows or boats dumping or discharging such forbidden matter in any place other than that specified in such permit shall be liable to punishment therefore, as provided in section 1 of the said act of June 29, 1888; and the owner and master, or person acting in the capacity of master, of any tug or towboat towing such scows or boats shall be liable to equal punishment with the owner and master, or person acting in the capacity of master, of the scows or boats; and, further, every scowman or other employe on board of both scows and towboats shall be deemed to have knowledge of the place of dumping specified in such permit, and the owners and masters, or persons acting in the capacity of masters, shall be liable to punishment, as aforesaid, for any unlawful dumping, within the meaning of this act or of the said act of June 29, 1888, which may be caused by the negligence or ignorance of such scowman employe; and, further, neither defect in machinery nor avoidable accidents to scows or towboats, nor unfavorable weather, nor improper handling or moving of scows or boats of any kind whatsoever shall operate to release the owners and master and employes of scows and towboats from the penalties hereinbefore mentioned.

"'Every scow or boat engaged in the transportation of dredgings, earth, sand, mud, cellar dirt, garbage, or other offensive material of any description shall have its name or number and owner's name painted in letters and numbers at least 14 in. long on both sides of the scow or boat; these names and numbers shall be kept distinctly legible at all times, and no scow or boat not so marked shall be used to transport or dump any such material. Each such scow or boat shall be equipped at all times with a life line or rope extending at least the length of and 3 ft. above the deck thereof, such rope to be attachel to the coaming thereof, also with a life preserver and a life buoy for each person on board thereof, also with anchor to weigh not less than 275 lbs., and at least 100 ft. of cable attached thereto; a list of the names of all men employed on any such scow or boat shall be kept by the owner or master thereof and the said list shall be open to the inspection of all parties. Failure to comply with any of the foregoing provisions shall render the owner of such scow or boat liable upon conviction thereof to a penalty of not more than $500.

"'The supervisor of the harbor of New York, designated as provided in section 5 of the said act of June 29,1888, is authorized and directed to appoint inspectors and deputy inspectors, and, for the purpose of enforcing the provisions of this act and of the act aforesaid, and of detecting and bringing to punishment offenders against the same, the said supervisor of the harbor, and the inspectors and deputy inspectors so appointed by him, shall have power and authority:

"'First.—To arrest and take into custody, with or without process, any person or persons who may commit any of the acts or offenses prohibited by this section and by the act of June 29, 1888, aforesaid, or who may violate any of the provisions of the same: Provided, That no person shall be arrested without process for any offense not committed in the presence of the supervisor or his inspectors or deputy inspectors, or either of them: And provided further, That whenever any such arrest is made the person or persons so arrested shall be brought forthwith before a commissioner, judge, or court of the United States for examination of the offenses alleged against him; and such commissioner, judge, or court shall proceed in respect thereto as authorized by law in case of crimes against the United States.

"'Second.—To go on board of any scow or towboat engaged in unlawful dumping of prohibited material, or in moving the same without a permit, as required in this section of this act, or otherwise violating any of the provisions of this section of this act, and to seize and hold said boats until they are discharged by action of the commissioner, judge, or court of the United States before whom the offending persons are brought.

"'Third.—To arrest and take into custody any witness or witnesses to such unlawful dumping of prohibited material, the said witnesses to be released under proper bonds.

"'Fourth.—To go on board of any towboat having in tow scows or boats loaded with such prohibited material, and accompanying the same to the place of dumping, whenever such action appears to be necessary to secure compliance with the requirements of this act and of the act aforesaid.

"'Fifth.—To enter gas and oil works and all other manufacturing works for the purpose of discovering the disposition made of sludge, acid, or other injurious material, whenever there is good reason to believe that such sludge, acid, or other injurious material is allowed to run into the tidal waters of the harbor in violation of section 1 of the aforesaid act of June 29, 1888.

"'Every person who, directly or indirectly, gives any sum of money or other bribe, present, or reward, or makes any offer of the same to any inspector, deputy inspector, or other employe of the office of the supervisor of the harbor with intent to influence such inspector, deputy inspector, or other employe to permit or overlook any violation of the provisions of this section or of the said act of June 29, 1888, shall, on conviction thereof, be fined not less than $500 nor more than $1,000, and be imprisoned not less than six months nor more than one year.

"'Every permit issued in accordance with the provisions of this section of this act, which may not be taken up by an inspector or deputy inspector, shall be returned within four days after issuance to the office of the supervisor of the harbor; such permit shall bear an indorsement by the master of the towboat, or the person acting in such capacity, stating whether the permit has been used, and, if so, the time and place of dumping. Any person violating the provisions of this section shall be liable to a fine of not more than five hundred dollars nor less than one hundred dollars.'"

Section 9.—That section 4414 of the Revised Statutes of the United States be amended by inserting in the first paragraph thereof, after the words "and Burlington, Vermont," and before the words "one inspector of hulls," the words "Honolulu, Hawaii, and San Juan, Porto Rico;" and that the said section be further amended by inserting in the fifth paragraph

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thereof, after the words "and Norfolk, Virginia," and before the words, "at the rate of two thousand dollars," the words "Honolulu, Hawaii, and San Juan, Porto Rico."

Section 10.—That on and after Jan. 1, 1909, the local inspectors of steamboats shall at least once in every year inspect the hull and equipment of every seagoing barge of one hundred gross tons or over, and shall satisfy themselves that such barge is of a structure suitable for the service in which she is to be employed, has suitable accommodations for the crew, and is in a condition to warrant the belief that she may be used in navigation with safety to life. They shall then issue a certificate of inspection in the manner and for the purposes prescribed in sections 4421 and 4423 of the Revised Statutes.

Section 11.—That every such barge shall be equipped with the following appliance of kinds approved by the board of supervising inspectors. At least one lifeboat, at least one anchor with suitable chain or cable, and at least one life-preserver for each person on board.

Section 12.—That a register, enrollment, or license shall not be issued or renewed by any collector or other officer of customs to any such barge unless at the time of issue or renewal such barge has in force the certificates of inspection prescribed by section 10 and on board the equipment prescribed by section 11.

Section 13.—That if any such barge shall be navigated without such certificate of inspection, or without any part of the equipment prescribed by section 11, the owner shall be liable to a penalty of $500 for each offense.

Section 14.—That the chairman of the light house board, the supervising inspector general of the steamboat inspection service, and the commissioner of navigation shall convene as a board at such times as the secretary of commerce and labor shall prescribe to prepare regulations limiting the length of hawsers between towing vessels and seagoing barges in tow and the length of such tows within any of the inland waters of the United States designated and defined from time to time pursuant to section two of the act approved Feb. 19, 1895, and such regulations when approved by the secretary of commerce and labor shall have the force of law.

Section 15.—That the master of the towing vessel shall be liable to the suspension or revocation of his license for any wilful violation of regulations issued pursuant to section 14 in the manner now prescribed for incompetency, misconduct, or unskillfulness.

Approved, May 28, 1908.

MERCHANT MARINE LEAGUE.

The nominating committee of the Merchant Marine League of the United States held a meeting in the Perry-Payne building, Cleveland, on Friday last. Mr. J. H. Dempsey acted as chairman and there were present, in addition, Mr. Harvey D. Goulder, Mr. Abraham Stearn, Mr. Charles S. Howe, Wm. H. Hunt, Col. J. J. Sullivan, W. P. Murray, Mr. Ambrose Swasey and Mr. John A. Penton.

The purpose of the meeting was to select a successor to Mr. Harvey D. Goulder as president of the league, Mr. Goulder having resigned subject to the appointment of his successor by July 1, owing to the fact that he could not take longer from his business the time necessary to satisfactorily discharge the duties of the office.

At a meeting of the sub-committee appointed by the general committee of the Merchant Marine League to nominate a president held in the office of Mr. W. P. Murray, Western Reserve building, on May 6, the name of Mr. Joseph G. Butler Jr. of Youngstown was presented and Mr. Ambrose Swasey was requested to see Mr. Butler and ascertain whether he would serve. Mr. Swasey reported at the meeting on Friday last that Mr. Butler was willing to serve provided that the league wanted him, and after a general discussion participated in by all present, Mr. Butler was unanimously elected president of the Merchant Marine League.

Regarding his own resignation, Mr. Goulder wrote to the members of the league a few weeks ago as follows:

"It has been very well understood for months that it has been and is impossible for me to continue to give the time and effort and expense involved in the presidency of the Merchant Marine League as I have endeavored. Therefore, some of the important members of the league came to my aid, and my resignation, first presented a year and a half ago, and recently insisted upon by me, has been accepted, subject to the appointment of my successor by July 1.

"We have done a very good work in aid of the effort of Senator Gallinger and the ocean mail bill, which, on a test vote, received the support of the senate by four to one, and would have gone through the house had it not been for the refusal of Mr. Burton, the congressman from this district, to consider the wishes of the president, the members of his cabinet, nearly all of his republican associates in both houses of congress, his constituents in this district and the declarations of his party as made in national and state conventions, and his unusual methods of affiliating with political opponents and thus securing the aid of democrats in the house to defeat a measure so urgently demanded by those business interests of the country which desire the extension of our trade with foreign countries.

"For the new president of the league I bespeak your earnest efforts, here pledging myself to give every aid I can. My withdrawal from the presidency is simply because I cannot give my whole time to the cause, as I would like to do."

NEW TYPE OF HATCH COVER LOCK.

Patents are being issued to Orten Peterson Peckham, of River Rouge, Mich., for a new type of hatch cover lock that is said to be a decided improvement on other devices of this nature. The lock is entirely of metal and so designed that it may be operated either singly or several together, one movement of a lever being sufficient to perfectly lock or unlock the device. Another feature is that it is easily attached to any form of hatch and its mechanical principle insures long life. Further information may be obtained from the advertising columns of this issue or from the inventor.

Secretary Metcalf has decided that the big 100-ton floating derrick authorized by the recent naval appropriation bill shall be located at the Boston navy yard. This will mean a boom to naval business at that yard, especially in the repair of heavy guns. The derrick is to cost $250,000 and is rigged on a pontoon so as to be portable. The derrick has a lifting capacity of 100 tons and it can handle the big 85-ton guns like so many bales of hay. Specifications will be prepared by the bureau of yards and docks, and bids will be asked for Aug. 1. In all probability, in view of its future location, the principal bidders will be New England ship building concerns.

The issue by the Cunard Steamship Co. of £800,000 in 4½ per cent mortgage debenture stock, redeemable between 1911 and 1920, at 102, issue price 97, has been a success. The issue is to provide for the cost of new tonnage and for the general purpose of extending its business.

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THE SUBJECT OF TIME.

(Continued from June 18.)

It is not necessary to change your time so that it will show the same as the clocks of Buffalo, or in other words to set it ahead just one hour. In comparing your time at Buffalo, just see that the difference is one hour (you should be slow one hour). If you left Buffalo for Chicago or Duluth, and your watch is set to Buffalo or seventy-fifth meridian time, it is not necessary to set your time to that of Chicago or Duluth, in order to do this work, in fact it is much better to work from one meridian, for by so doing you are less liable to mistakes. The ninetieth meridian is probably best suited for this purpose, on account of the majority of lake ports employing it.

To get the correction for longitude, all that is necessary to do is to prick off the longitude for your position and subtract it from 90 or 75 (the less from the greater in every case). Convert this difference into time and you have it.

Do not depend too much on these rules. They are absolutely correct but hard to remember when only learned parrot fashion. Get the correct idea of this time subject thoroughly impressed on the mind, and the rules will make themselves. Picture and reason them out for yourself. This is the kind of knowledge that counts. Time is an interesting subject and one of inestimable worth, and everybody on board, especially those in the for'ard end, ought not only to be thoroughly acquainted with all of the foregoing facts, but they should be capable of giving an intelligent explanation. If you understand what has already been said you can consider yourself a cut or two above your shipmates. It is surprising, even among men of intelligence and learning, what little knowledge they possess on matters of this kind.

SOMETHING WELL TO REMEMBER.

In the application of the equation of time to obtain the corresponding mean time it is well to know that the equation of time is addative to apparent time from about June 15 to about Aug. 31, and from Dec. 25 to April 15, and it is subtracted from apparent time from about April 16 to June 14, and from about Sept. 1 to Dec. 24.

TIME AND LONGITUDE.

The longitude of a place is its distance east or west from a given meridian measured on a parallel of latitude. The given meridian, as far as the purposes of navigation are concerned, is that of Greenwich, for the reasons given under charts. When the International Meridian Conference met in Washington in 1884, it recommended the adoption of the meridian of the Greenwich observatory, near London, England, as the prime meridian of all nations.

Bear in mind that the constant contraction of the meridians as we proceed polarwise, has nothing whatever to do with the problems of longitude and time; consider the earth flat, like that of Mercator's projection. On the same meridian the time is precisely the same from pole to pole anywheres on that meridian; the meridian opposite it on the other side of the earth, has just 12 hours (180°) difference in time.

COMPUTATION OF LONGITUDE BY TIME.

Since any given point on the earth's surface passes through 360°—one entire rotation—in 24 hours, it must pass through 360° ÷ 24, or 15° in one hour; and 1° is 1/15 of one hour, or four minutes. Hence, if the difference of time marked at two places be known, their difference in longitude can at once be ascertained, and similarly, if the difference in time can be determined.

It is the earth's rotation on its axis that makes the sun appear to pass from east to west around the earth, or through 360° of longitude once in 24 hours of time.

COMPARISON OF LONGITUDE AND TIME.

For a difference of		There is a difference of
15° of longitude	=	1 hour of time.
15′ of longitude	=	1 minute of time.
15″ of longitude	=	1 second of time.
1° of longitude	=	4 minutes of time.
1′ of longitude	=	4 seconds of time.
1″ of longitude	=	4 thirds, or 1/15 seconds of time.

From the above we derive the following rule:

To convert longitude of arc into longitude of time, or to find the difference in time between any two places when the difference of longitude is given: Multiply the numbers expressing the difference in longitude between the two places in degrees, minutes and seconds, by 4; that is, multiply each member of the quantity by 4 and divide by 60, adding any figures left over to the result obtained from the next number to the right.

By this operation the degrees are reduced to minutes, the minutes to seconds and the seconds to thirds of time.

Example: Convert 87° 22′ 30″ into longitude of time.

87°	22′	30″
4	4	4
60)348m(5h	60)88s(1m+	60)120t(2s
300	60 48m	120 28s
48m	28s 49m	30s

Answer 5 hours 49 minutes 30 seconds.

Turn 50° 40′ 15″ of longitude of arc into longitude of time.

50°	40′	15″
× 4	× 4	× 4
200m	160s	60)60t(1s
2m	1s	60
60)202m(3h	60)161(2m	
180	120	
22m	41s	

Answer 3 hours 22 minutes 41 seconds.

Analysis.—Since 1° of longitude makes a difference of 4 minutes of time, and 1′ makes a difference of 4 seconds of time, there is a difference of 4 times as many minutes and seconds of time as there are degrees, minutes and seconds of longitude.

The difference of longitude between two places is 60° 30′ 24″. What is the difference in time?

60°	30′	24″	
4	4	4	
240m	120s	60)96t(1s	
2m	1s	60	
60)242m(4h	60)121(2m	36t	
240	120		
2m	1s		

Answer 4 hours 2 minutes 1 second 36 thirds, or 1.6 seconds.

The difference of longitude between two places is 73° 1′. What is the difference in time?

73°	1′	
4	4	
60)292m(4h	4s	
240		
52m		

Answer 4 hours 52 minutes 4 seconds.

Two places differ in longitude 60°. What is the difference in time? Answer 4 hours.

Find the difference between the sun time of London and that of Chicago, 87° 35′ west of London.

87°	35′	
4	4	
348m	60)140s(2m	
2m	120	
60)350m(5h	20s	
300		
50m		

Answer 5 hours 50 minutes 21 seconds.

Two places differ in longitude 38° 18′. What is their difference in solar time? Answer 2 hours 29 minutes 12 seconds.

Find the difference in sun time between two places in longitude 74°, 31° and 93° 14′ west of Greenwich, respectively.

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93° 14′ W.
74° 31′ W.

Diff. long. 18° 43′ W.
18° 43′
4 4

72m. 60)172(2m.
2m. 120

60)74(1h. 52s
60

14m.

Ans. 1hr. 14m. 52s.

What is the difference in sun time between one place in longitude 21° 40′ W. and another place in longitude 7° 52′ E.?

The difference in longitude is 29° 32′, which multiplied by 4 gives a product of 1h. 58m. 8s.

What is the difference in sun time between one place in 140° east long. and another in 125° west long.?

Long. 140° E.
Long. 125° W.

265°, being more than 180° take it from 360°; hence 360° — 265° = 95°

4

60)380m(6h.
360

20m.

Ans. 6hrs. 20mins.

Note.—Remember the rules you learned in regard to longitude in the use and handling of charts. It is a good plan to look at a map of the world when working these examples, as it will help to form the correct solution of them.

A table showing the longitude of the various places on the globe:

Milwaukee (pierhead light-house)	87° 54′ W
Port Huron—Fort Gratiot	82° 25′ W
Detroit—Belle Isle	82° 57′ W
Cleveland—West pier	81° 43′ W
Buffalo—Pierhead	78° 54′ W
Ogdensburg, N. Y.	75° 30′ W
Duluth—Pierhead	92° 05′ W
Marquette	87° 22′ W
Albany	73° 44′ 50″ W
New York	74° 3′ W
Ann Arbor	83° 43′ W
New Orleans	90° 2′ 30″ W
Astoria, Ore.	124° W
Boston	71° 3′ 30″ W
Berlin	13° 23′ 45″ E
Bombay	72° 54′ E
Cincinnati	84° 29′ 31″ W
Chicago	87° 37′ 45″ W
Cambridge, Mass.	71° 7′ 40″ W
Jefferson City, Mo.	92° 8′ W.
Mexico	99° 5′ W
Paris	2° 20′ E
Rome	12° 27′ E
Richmond, Va.	77° 25′ 45″ W
San Francisco	122° 25′ 45″ W
St. Paul, Minn.	95° 4′ 55″ W
St. Louis	90° 15′ 15″ W
Washington, D. C.	77° 0′ 15″ W

Find the difference in sun time between:

Buffalo and Chicago.....Ans. 34m. 55s.
Chicago and Cleveland.....Ans. 23m. 39s.
Chicago and Duluth.....Ans. 17m. 49s
Buffalo and Duluth.....Ans. 52m. 44s.
Duluth and Ogdensburg..Ans. 1h. 6m. 20s.
Detroit and Marquette.....Ans. 17m. 40s.
Chicago and Milwaukee.....Ans. 1m. 5s.
Milwaukee and Port Huron.Ans. 21m. 56s.
Washington and Rome..Ans. 5h. 47m. 49s.
New Orleans and New York....
.....Ans. 1h. 3m. 58s.
Ann Arbor and Berlin..Ans. 6h. 28m. 27s.
Boston and San Francisco.....
.....Ans. 3h. 25m. 33s.

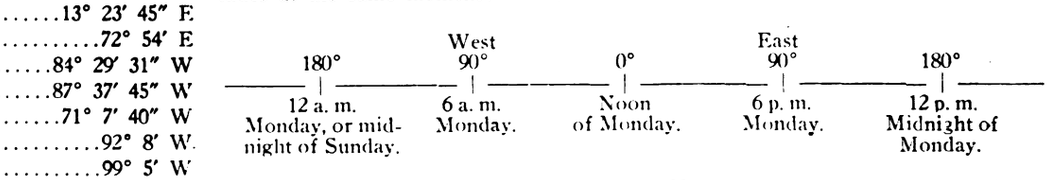
Note.—Take from the table the required longitude of the different places and find their difference of longitude, which convert into time.

Since the sun appears to move from east to west, when it is 12 o'clock at one place, it will be past 12 o'clock at all places east, and before 12 at all places west. Hence, knowing the difference in time between two places, and the exact time at one of them, the exact time at the other is found by adding their difference to the given time, if it is east, and by subtracting, if it is west., Or. it may be explained thus: As the earth really turns from west to east, the sun reaches the meridian of any place east of us before it reaches ours, and it reaches the meridian of any place west of us after it reaches ours. Hence, at any given time of day with us, it is later in the day at all places east of us and earlier in the day at all places west of us.

DIFFERENCE OF TIME MARKED AT THE SAME MOMENT.

The moment at which the sun crosses the meridian of a given place, is noon or mid-day at that place. The meridian which is 90°, or a quarter of a rotation, to the eastward has six hours later time at the same moment, and one which is 180° east, 12 hours later. Meridians at corresponding distances to the westward have a corresponding number of hours earlier time; so, in proportion, of less distances.

The diagram following illustrates the different time marked in different longitudes at the same moment:



Thus it happens that mariners, starting from a given point and sailing around the world to the west, lose a day in making the circuit, while in sailing eastward they gain a day. To correct this error in the former case, they must, at some moment, add one day to their reckoning of time, making the date 24 hours later, and in the latter case drop a day. This is done at the meridian of 180°. See Circumnavigator's Day.

RULE FOR CONVERTING LONGITUDE OF TIME INTO LONGITUDE OF ARC.

To find the difference of longitude between two places, when the difference of time is known; or, to convert longitude of time into longitude of arc—Multiply the hours by 15 to get degrees. Divide the number of minutes by 4 and add the quotient to the number of degrees. If any numbers are left over multiply them by 15. Divide the seconds by 4 and add the quotient to the minutes. Finally multiply the remaining seconds by 15.

Example: Convert 5 hours 49 minutes 30 seconds into longitude of arc.

5 4)49(12° 4)30(7′
15 4 28
— — —
75° 9 2 × 15 = 30′
12° 8
— —
87° 1 × 15 = 15′
7
—
22′

Answer 87° 22′ 30″.

This conversion is based upon the fol lowing facts: Since every hour of time corresponds to 15° of longitude there will be as many degrees as there are 15 times the hours; and since 4 minutes of time makes a difference of 1° of longitude, there will be one-fourth as many degrees of longitude as there are minutes of time, and one-fourth as many minutes of longitude as there are seconds of time.

Turn 3 hours 22 minutes 41 seconds into longitude of arc.

3h 4)22m(5° 4)41s(10′
15 20 40

45° 2 × 15 = 30′ 1 × 15 — 15″
5° 10′

50° 40′

Answer 50 ° 40′ 15″.

The earth rotates on its axis once in 24 hours of mean solar time. What part of a rotation does it make in 12 hours? Answer 180°.

How many degrees of the earth's surface pass under the sun's rays in 4 hours? Answer 60°.

When it is 6 o'clock at Chicago, what

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is the hour 15° east of Chicago, and 15° west of Chicago? Answer 7 o'clock and 5 o'clock.

When it is noon at New York, what is the hour 15° east of New York and 30° west of New York? Answer 1 o'clock and 10 o'clock.

If the difference in time of Boston and of St. Louis is 1 hour 2 minutes, what is the difference in their longitude? Answer 18° 45′.

A man left New Orleans and traveled until his watch was 1 hour 2 minutes too fast. How far has he traveled in longitude, and in what direction? Answer 15° 30′ west.

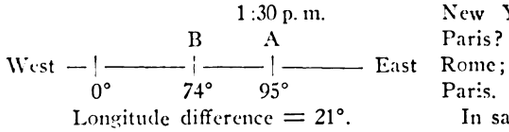
Two persons at different points, observe an eclipse of the moon; one seeing it at 9:30 p. m., and the other at midnight. What is the difference in their longitude? Answer 37° 20′.

A tourist leaves home at 12 m. on Monday, and on Saturday finds his watch 1 hour 15 minutes slow. In what direction has he been traveling? How much has he changed his longitude? Answer west 18° 45′.

A and B start from opposite points and travel toward each other. When they meet A's watch is 40 minutes slow and B's 1 hour fast. How far apart in longitude are the two points of starting, and in what direction did each travel? Answer 25°. A traveled east and B west.

Given the longitude of A as 95° east, and that of B as 74° east; and the time at A as 1:30 p. m., to find the time at B.

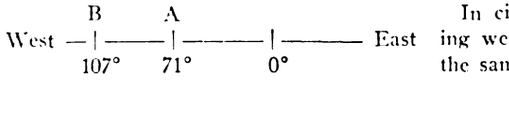
Since the latitude of B has no bearing upon its time, both places may be located upon the same line running east and west.



Longitude difference = 21°.

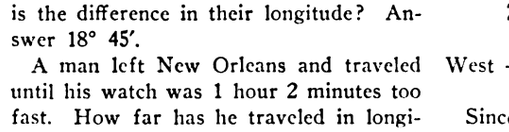
Locate the prime meridian (that of 0°), then the meridian of 74° and 95° east (just as in illustration). Mark above the last two the names of the places, B and A. Write above A its given time, 1:30 p. m. To find the time at B, we must find the difference of time between B and A. The difference in longitude is 95° — 74° = 21°. The difference in time is 21° × 4 = 84 minutes, or 1 hour 24 minutes, and as the more easterly of the two places has the later time, to find the time of B subtract this difference of longitude converted into time from the time of A and the result will be the time of B. In this case, the time is 6 minutes after noon, or 12:06 p. m.

A is situated in 71° west longitude, B in 107° west longitude. What time is it at B, when it is noon at A?



Answer. It is 2 hours 24 minutes before noon, or 9:36 a. m. It is earlier at B than at A because A is so much farther to the eastward of B, and as a consequence gets the sun to its meridian that much sooner than it reaches B's meridian.

Find the longitude of B, whose time is 8:10:30 a. m., when it is 7:15 a. m. at A, whose longitude is 156° 48′ west.



Since B has the later time, its location is east of A. The difference in time, being nearly an hour, shows the difference in longitude to be nearly 15°. Find the exact difference. Do you add to or subtract from the longitude of A to get the longitude of B?

When it is noon at B, what is the time at A, the former being in longitude 44° east, and the latter in longitude 57° west? Answer, it is 5:16 a. m.

When it is 9 o'clock at Washington, it is 7 minutes 4 seconds past 8 o'clock at St. Louis. Find the difference of longitude. Answer, 13° 14′.

Noon comes 1 hour 5 minutes 42 seconds sooner at Quebec that of Chicago, whose longitude is 87° 37′ 45″. What is the longitude of Quebec? Answer, 71° 12′ 15″ W.

When the days and nights are of equal length (sun on the equator about March 21 and Sept 21) and it is noon on the first (Greenwich) meridian, on what meridian is it then sunrise? Sunset? Midnight? Answer, 90° W.; 90° E.; 180° E or W.

How much later does the sun rise in New York than in Rome? Than in Paris? Answer 5 hours 40 minutes later, Rome; 5 hours 5 minutes 32 seconds later, Paris.

In sailing from San Francisco to Bombay, will your time gain or lose, and how much? Answer 10 hours 58 minutes 37 seconds, gains.

At a certain time at Cincinnati the time at Buffalo is 22 minutes 8 seconds later; what is the difference of longitude between the two places? Answer, 5° 32′. What is the longitude of Buffalo? Answer, 78° 55′ W.

Note.—The word "time" in the foregoing problems means "mean solar time." This topic should be studied in connection with the study of mathematical geography. The globe should be used to show that all places on the same meridian have the same solar time, that a difference in longitude of 15° produces a difference in time of 1 hour, and that the more easterly of two places has the later time.

CIRCUMNAVIGATOR'S DAY.

In circumnavigating the globe by sailing west the ship and the sun move in the same direction, but by sailing east the ship and the sun move in opposite directions. In the former case the sun overtakes the ship, and in the latter case the sun advances to meet the ship. Therefore, in sailing west the ship's day is lengthened and in sailing east it is shortened at the rate of one hour for every 15° of longitude made.

Should a vessel start from Greenwich and sail east until the meridian of 180° was reached, arriving at that point at 2 o'clock in the morning of Sunday, the 20th day of the month (according to the ship's date and time), it would only be 2 o'clock in the afternoon at Greenwich on Saturday the 19th. Thus the ship's time would be 12 hours ahead of the time at Greenwich. Now if the ship, without changing her date, continued sailing to the eastward until Greenwich was reached, another 12 hours would be gained, and the ship's time would be 24 hours, or one day ahead of the Greenwich time.

On the other hand, should a vessel start from Greenwich and sail west until the meridian of 180° was reached, arriving at that point at 2 o'clock in the morning of Sunday, the 20th day of the month (according to the ship's date and time), it would be 2 o'clock in the afternoon of the same day (Sunday 20th) at Greenwich, so that the ship's time would be 12 hours behind the Greenwich time. If the ship, without changing her date, continued to sail to the westward until Greenwich was reached, another 12 hours would be lost, and the ship's time would be 24 hours, or one day, behind the Greenwich time.

When crossing the meridian of 180°, if the ship is sailing eastward, the navigator must reckon the given day over again, so that there will be two Sundays, or two Mondays, Tuesdays, etc., in the log book for that particular week, according to the day that he crosses. By doing this the ship's date will be found to correspond with the Greenwich date when the vessel reaches that port.

But when crossing the meridian of 180°, if the ship is sailing westward, the navigator must skip a day, so that there will be a Sunday, Monday, Tuesday, etc., omitted in the log-book for that particular week, according to the day that he crosses. This insures the ship's date agreeing with the Greenwich date when the ship reaches the latter port. The great point to remember is that the navigator is not to interfere with the Greenwich date shown by chronometer, but that he is religiously to keep the run of and hold on to same.

For a vessel crossing the 180th meridian it is possible for those forward to have 12 hours difference in their time from those situated aft. The faster or slower time depending whether the ves-

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sel is crossing the meridian going to the westward or crossing heading to the eastward. For a vessel in heading to the westward in crossing and when this meridian is in transit with the athwartship section of the vessel the bow is separated from the stern in time by 12 hours, the former being 12 hours in advance of the former. Crossing to the eastward, just the opposite conditions would prevail.

QUESTIONS FOR MASTERS AND MATES.—NO. 3.

40. What two kinds of magnetism are there?

41. Which kind of magnetic poles attract each other?

42. What is repulsion in magnetism? Give an example of it.

43. Why is it that the north end of the compass needle directs itself toward north?

44. What is the north pole of the earth's magnetism and where is it situated?

45. Define the true or geographical north pole of the earth.

46. Where does the direction north begin?

47. Are there places on the earth where the magnetic needle actually points to the true north pole of the earth? Does the needle at the same time point to the the north magnetic pole?

48. On which of the great lakes do we have easterly variation and on which do we have westerly variation?

49. What is the true bearing of the true north pole for an observer situated at Cleveland? What would be the bearing of the north magnetic pole for the same observer? What are these two directions called?

50. Why is it that variation is called easterly and westerly?

51. Which way do you allow easterly variation in turning a true course into a correct magnetic course?

52. Which end of the compass needle has the greatest amount of magnetism, the north or the south end? Why?

54. What is a four-point bearing? Give an example and explain its use.

55. In a right-angled triangle what is the longest side called?

ANSWERS TO QUESTIONS FOR MASTERS AND MATES.—NO. 3.

40. North and south magnetism, designated red and blue polarity—red for north and blue for south.

41. Poles of contrary names or unlike poles.

42. The opposite of attraction; to drive away. The like pole of one magnet presented to the like pole of a balanced magnet will cause the balanced magnet to move away; presenting the north pole of a magnet to the north end of a compass needle.

43. It is attracted by the north pole of the earth's magnetism, and this north magnetic pole is located in the far north. It contains south magnetism, and, therefore, attracts the north end of the compass needle, being opposite in magnetism.

44. The earth itself is a huge magnet, and the north pole of its magnetism is a place on the earth's surface representing that magnet and where the magnetism that attracts the north point of the dipping needle the greatest. It is situated in the Arctic ocean, near Baffins bay, some 1,200 miles south of the true pole.

45. The ends of the earth's axis. Two points of 90 degrees north or south of the equator.

46. At the true south pole.

47. Yes, along the line of no variation. Yes.

48. Easterly on Lakes Superior and Michigan and westerly on the other lakes.

49. True N. N 2 degrees 45 minutes west, or the amount of the variation at Cleveland west of north, north true and north magnetic.

50. Because easterly means to the right and westerly to the left. The compass needle produces an easterly effect when it is drawn to the right and a westerly effect when drawn to the left.

51. Toward the left.

52. There is no difference, or there should be no difference.

53. An operation for fiinding the ship's distance from any given object. In form it is a right-angled isosceles triangle. Example:—A ship steaming north at 12 miles an hour at 2 p. m. had Sanilac lighthouse bearing NW. At 2:30 p. m. it bore W, or abeam. In the interval the ship had run six miles, which is her distance from the light at the time of taking the second bearing.

55. The hypotenuse.

QUESTIONS FOR WHEELSMEN AND WATCHMEN.

521. Describe North Manitou island?

522. About how far and in which direction is South Fox island from North Manitou island?

523. How does the west side of South Manitou island appear?

524. How does North Manitou island look from the westward?

525. How does North Fox island bear from South Fox island?

526. What is the true course and distance from South Fox passage to Grays Reef lightship?

527. How close to Beaver island does this course take you?

528. How will the southeast end of Beaver island line up with this course?

529. What reefs are there to the westward of Beaver island that are not buoyed?

530. How much of a berth should you give the northwesterly end of South Fox islands?

ANSWERS TO QUESTIONS.

511. They lie south of South Fox island and between North Manitou island and South Fox island.

512. The shoals are detached and the north end is marked by a black gas buoy and the southern extremity by a red nun buoy. These shoals extend about nine miles south of South Fox island. They are rocky and the least water is 12 ft. This 12-ft. spot is marked by a red and black nun buoy and bears S by W from South Fox Island light, distant 4¼ miles.

513. A good passage 10 miles wide.

514. Between the south end of South Fox island and the black gas buoy marking the northerly end of South Fox Island shoals. The passage is two miles in width.

515. About two miles.

516. From all winds except from NE to about SE.

517. Good.

518. Is about 3½ miles long and about as many wide; is hilly and bluff on the west side and lower and wooded on the east side. All its shores are deep close to except on the south and southwesterly sides where the water is shoal for ¾ miles. There is also an 18-ft. detached shoal about 2½ miles southwest of the island.

519. On account of a detached shoal with 18 ft. of water on it bearing about SW ¾ W 2⅜ miles from the most southerly point of the island.

520. About three miles.

TYNE-BUILT LAKE STEAMER.

The Western Steamship Co., Toronto, is having a steamer built on the Tyne and to be named J. A. McKee, in honor of the president of the company. The leading particulars are: Length, between perpendiculars, 248 ft.; breadth, extreme, 43 ft.; depth, molded, 25 ft.; forecastle, 42 ft. The officers' quarters are forward, the captain's cabin being on the forecastle, those for the other officers being below, in addition to two spare cabins. The chief engineer's and steward's cabins are aft on the upper deck, and the general crew are also located aft, on the upper and main decks. The boat is to have seven cargo hatchways, each 8 x 29 ft., large grain bin, 14 x 34 ft. by 7½ ft. high. The machinery comprises duplicate triple-expansion engines, with cylinders 20½, 33 and 54 in. diam., by 36 in. stroke,

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with direct-acting reversing gear, and supplied with steam by two boilers of the cylindrical multi-tubular type, 10 ft. 6 in. long by 13 ft. 6 in. diam., at a pressure of 180 lbs. There are also three steam winches, and three derricks, designed and placed for the expeditious handling of cargo; and a complete electric light installation and steam heating equipment.

INTERNATIONAL YACHT RACE IN HONOR OF COLUMBUS.

Spain intends to commemorate Aug. 3, next, the anniversary of the departure from Palos of the ships Santa Maria, La Pinta and La Nina, by yacht races which, starting from that port, will make the first stage of the voyage which was made by Columbus and the mariners who discovered the West Indies.

The races will be from Palos, whence Columbus set sail to the Canaries. As the distance is 700 miles, requiring several days' navigation, cash prizes of considerable amount are required, and as this is a Spanish-American festivity commemorating a great event in which the people who form the nations of this continent are interested, the Spanish authorities invite the co-operation of the countries of America.

The mayor of Palos will not accept prizes for safe-keeping, but merely requests that they be offered, for he desires the winning yachtsmen to receive the prizes won by them directly from the giver, and he also states at the same time that the prizes are to bear the names of each of the American republics, of the Canaries, Puerto Palos, and Spain.

This year, by a happy coincidence, high water is at 6 o'clock in the morning on Aug. 3 (these being the day and hour that, 415 years ago, the Santa Maria, Pinta and Nina set sail at high water) which will be taken advantage of this anniversary by the American-Spanish yachts to perform the first part of the journey Columbus made in 1492.

The mayor of Puerto Palos has arranged that the first sailing yacht to arrive shall anchor at the Palos quay bearing east, and that those arriving later shall anchor upstream, in the order of their arrival; so that on Aug. 3 all the vessels which shall take part in the regatta shall pass over the exact spot from which Columbus' caravels sailed.

So as to insure receiving daily news of the progress of the yachts, each one will have a flag numbered according to the order of her arrival at Puerto Palos, to enable the steamers accompanying them to communicate news by means of the Marconi apparatus, to the receiving stations ashore; one at the Columbus monument at La Rabida and another at Punta Anaga, in the north of the Island of Teneriffe.

The Nautical Club at Las Palmas and the Royal Teneriffe Club have offered prizes and will make arrangements to entertain the yachtsmen. The winning post will be the port of Santa Cruz de Teneriffe, which is the capital of that archipelago.

AROUND THE GREAT LAKES.

D. McKay has been appointed harbor master at Goderich, Ont.

Capt. Harris W. Baker will raise the passenger steamer Arundel which went on the rocks near Alexandria bay, St. Lawrence river, on June 18.

The Reiss Coal Co. of Sheboygan has leased Dock 3 of the Pittsburg Coal Co. and will handle coal at the head of the lakes this season.

On June 14, 1908, the characteristic of the lights on board the Limekiln Crossing North Light Vessel, No. 65, was changed from red to white.

W. P. Tindall, of Detroit, has been elected lake business manager of the Marine Engineers' Beneficial Association vice Joseph Blanchette, of Buffalo, resigned.

The barge Atmosphere while going up Belle river collided with the steamer City of Mt. Clemens which was loading a cargo of coal at Sicken's dock, inflicting damage of about $1,000.

The steamer Cherokee and schooner Chippewa, bound up with coal, went aground at Grassy Island, Detroit river, this week, but were released by the tug A. C. Harding without lightering.

The steamer J. J. Boland stranded last week near Port Huron, going on hard, as it was necessary to remove about 2,600 tons of coal before she could be floated. The wrecker Favorite released her.

Capt. Patrick Meyers of the schooner Bertha Barnes cleared from Chicago to Cleveland with coal last week. Capt. Meyers is probably the oldest man in active service on the lakes. He is 82 years of age and has been sailing continuously for over 60 years.

Quite a number of changes are being made in the steamer City of St. Ignace before she goes on the Cleveland-Mackinac run. She will be used as an express steamer in this service and will carry no freight.

The steamer John Dunn Jr., built for the United States Transportation Co., and the steamer F. G. Hartwell, built for G. A. Tomlinson, of Duluth, left the yard of the Toledo Ship Building Co. on their maiden trips on Saturday last. Both are products of the Toledo Ship Building Co.

The steamer David B. Meacham, the last of the three boats building for the Frontier Steamship Co., of which W. M. Mills is manager, was launched on Thursday of this week at the Ecorse yard of the Great Lakes Engineering Works.

An examination for the position of second mate for duty on board tenders in the 11th lighthouse district will be held in the offices of the inspector of the 11th district, Detroit, Mich., on July 10. Blank application forms can be obtained upon application to the office.

The steamer Alexis W. Thompson, bound out from the Irishtown dock at Cleveland with a cargo of coal, was stuck in the draw of the Superior street viaduct for about two hours. The draw had to be swung between the steamer's spars to let bridge traffic pass.

Barry Bros. Transportation Co., which has been operating a line of steamers betwen west shore points on Lake Michigan, has been placed in the hands of a receiver by Judge Charles H. Walker of the Cook county circuit court. George E. Brennan was appointed to take charge of the company's affairs.

The harbor dock line as it now exists along the shore off Minesota Point at Duluth will be moved back about 750 ft. by order of the secretary of war. Some years ago the harbor dock line on the point was extended about 1,000 ft. out into the harbor to care for many projected improvements, but nothing came of them and the room is now needed in the harbor basin.

The first collision of the season between two big freighters occurred at the Sault Sunday when the steamers Hoover & Mason of the Tomlinson fleet and the Howard L. Shaw of the Pittsburg Steamship Co.'s fleet collided. The Shaw was lying at the pier when the Hoover & Mason in leaving the lock took a sheer and struck her nearly head-on between No. 1 and No. 2 hatches on the port side. The Hoover & Mason's anchor broke through a couple of plates near the Shaw's stern. The plates are damaged clear down to the bilge. The Shaw will probably have to be docked.

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TAFT ON SHIPPING.

Wm. H. Taft, secretary of war in President Roosevelt's cabinet, was nominated for president of the United States at the Republican national convention held in Chicago last week. Upon the important subject of shipping there is fortunately no doubt of Mr. Taft's attitude, and should he be elected he would be a more strenuous advocate of government support to American shipping than even Mr. Roosevelt.

Mr. Taft's experience has been worldwide, no man having received a more thorough training in governmental affairs than he. For the past 10 years he has been the envoy of the American republic to all important international functions. Especially distinguished was his service in the Philippines. More than any other American in public life he has had opportunity of discovering the needs of the American ship, nor has he been backward in promulgating his views upon various public occasions.

His running mate, Congressman Sherman, is also quite as pronounced an advocate of government aid to American shipping as Mr. Taft, and has been one of the most loyal supporters of various measures that have been introduced in congress to relieve the present distressing condition of the American merchant marine. Congressman Sherman is a business man of wide experience and looks at this matter in a business light.

In an address before the board of trade at Lowell, Mass., on Feb. 19, last, Mr. Taft said:

"Now with respect to the merchant marine. That is a subject which calls for closest consideration. You can go the world around and see the American flag, in the Philippines, in Cuba—on the legation—in Porto Rico, and on individual vessels of the United States. But you rarely see it on a merchant vessel. That means that other people are doing our work in exporting merchandise; but I think we all agree that if some method could be devised by which our merchant marine would be put upon the proper basis, and our vessels of peace go out with the flag flying at the foremast, it would be better for our nation, and better for our pride as a people. I think we ought to make an experiment. I think we ought to try and see whether, by a reasonable mail subsidy, we may not produce lines between here and South America and between here and the Philippines which shall lead to other developments. We now earn enough in our foreign postal service—some three millions of dollars—that we might well bestow on those who are willing to devote their capital to an industry that would benefit our country."

Mr. Taft, in an address before the chamber of commerce of Trenton, N. J., on March 23, 1908, said:

"With our immense coast line on the Pacific, with the deep interest that we have in the Chinese trade, certainly we ought to take steps to assist the reconstruction and maintenance of steamers carrying the American flag from our west coast to the orient. The bill which offers inducements for the construction of ships to earn the mail subsidies proposed will be an experiment in this direction, and if it proves to be successful it ought to be followed by greater and greater government contributions to the building up of our merchant marine. I cannot understand any difference in principle between government assistance to our merchant marine and our protective tariff system, our system of improvement of internal waterways, or any other method by which the general welfare is promoted through the government's assistance of particular industries, in which all may engage. Let us hope that the mail subsidy bill will lead to the establishment of direct lines between New York and South America on the one hand, and between the Pacific coast, Japan, China and the Philippines on the other, and that it may be the means of pointing out how a wider system of maintenance of the marine may be inaugurated in the public interest."

A few weeks ago, in an address before the Commercial Club of Chicago, speaking of the future of our trade across the Pacific with the Philippines, Japan and China, Taft said:

"One step that we can take, so far as the merchant marine is concerned, is to seek the passage of the bill now pending in congress by which, through a subsidy, it is hoped, a regular line between the United States, Japan, China and the Philippines may be established, which, of course, will secure most of the American trade between the United States and China.

"The bill now pending appropriates in aid of capitalists who will construct steamships having a speed of 16 knots and will place them on the line between the Pacific coast, China, Japan and the Philippines, and between New York and South American ports, the fund of several millions which is now earned as a profit by the United States from the postage for foreign mail.

"If the protective principle is the correct one, if it is wise to expend government money in the development

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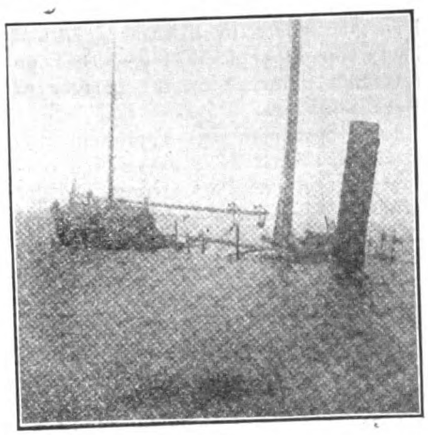
of a country by improving the waterways for the benefit of those who would use them, I am unable to see why the improvement of our merchant marine by subsidies offered to everyone who will comply with the conditions, is not justifiable, and if it produces ocean steamers flying the American flag and carrying the trade between the Pacific shore and China and Japan, it will certainly tend to improve and increase that trade."

FATE OF THE MINNIE E. KELTON.

The accompanying photograph shows the fate of the lake steamer Minnie E. Kelton which left the lakes for the Pacific coast on May 15, 1907. She made the journey from Milwaukee to San Francisco, a distance of 16,467 miles, meeting with slight mishap. She left Milwaukee on May 15, 1907. Her main mast broke on July 19 when she was about 85 miles off Santos, Brazil, but she made that port without assistance and arrived at San Francisco by Oct. 10 without further accident.



MINNIE E. KELTON, AS SHE APPEARED ON MAY 29. PHOTO TAKEN AT HALF EBB TIDE.

The accompanying illustration shows her as she lies on Smith Flats, Columbia river, between Astoria and Florel, where she was beached by the steam schooner Washington which picked her up off the Oregon coast early in May. Apparently it was a mistake to beach her on the flats because the Kelton began at once to bury herself in the sand. Owing to heavy weather it has been impossible to float her. Wrecking operations are shortly to be begun, however, when it is hoped to pull her into deep water and take her to dry dock at Portland.

The steamer Minnie E. Kelton was built of oak by R. W. Wheeler & Co., West Bay City, Mich., in 1894. She is 171 ft. long, 35 ft. beam and 12 ft., having a gross tonnage of 632. She was sold last year by the Michigan, Indiana & Illinois Line, Chicago, Ill., to Ganahl & Co., of San Francisco, Cal.

LAKE FREIGHT SITUATION.

While lake navigation may now be said to be open, the outlook is certainly not very encouraging. Some season charters have been made on a basis of 70 cents from the head of the lakes, which is 5 cents less than the rate which has prevailed for the last four years, but even at that figure not much business is offered. The fact is that ore has scarcely begun to move and some of the leading shippers are having all that they can do to take care of their own vessels. It will probably be some time next month before business is generally apportioned among the independent vessels.

Coal is moving quite freely, but there is nothing in it in carrying coal for 30 cents to the head of the lakes with no return cargo. Large carriers therefore prefer the 40 cent rate to Lake Michigan. Small carriers in the coal trade are in good demand; but the coal trade in itself cannot keep vessels profitably employed.

Such grain as is offering is being moved by the line boats.

PERMANENT LIGHTS PLACED.

The following lights have been established to replace the temporary lights along Isle aux Peches ranges, Lake St. Clair: Front light—A fourth order light, flashing white every 10 seconds, shown from a white, conical steel tower, 83 degrees, 33 minutes from Windmill Point light, on the axis of the 20-foot channel. The structure stands in 20 ft. of water, on a crib foundation 7 ft. high, and is 37 ft. from its base to the top of the ventilator on the lantern. The light is 38 ft. above the water, is visible 13.5 miles and illuminates the entire horizon. A square, one-story frame dwelling, painted white, is in rear of and attached to the tower. The approximate geographic positions of the light, as taken from triangulation sheet, showing location of improved 20-ft. channel, is: Latitude, north 42 degrees, 21 minutes, 59 seconds; longitude, west 82 degrees, 54 minutes, 20 seconds.

Rear light—A fixed red reflector light, shown from a white, conical, steel tower, surmounted by a black octagonal lantern, 3,300 ft. (5/8 mile), 227 degrees, 41 minutes, (S. W. ¼ W.) in rear of the preceding. The structure stands in 14 ft. of water, on a crib foundation 7½ ft. high, and is 57½ ft. above the water. Illuminates 135 degrees of the horizon and visible 15 miles. The approximate geographic position of the light, as taken from triangulation sheet, showing location of improved 20-ft. channel, is: Latitude, north 42 degrees, 21 minutes, 16 seconds; longitude, west 82 degrees, 54 minutes, 53 seconds.

NEW STEAMSHIP LINE.

Official announcement is made that the Texas City Steamship Co. has been formed to operate a line between New York City and Texas City, Tex., stopping at Brunswick, Ga., both south and north bound. From statements made on Saturday it appears that the new company will have a capital of $1,000,000, and will be incorporated under the laws of New Jersey.

Permanent organization of the Texas City Steamship Co. will be perfected in the early future, when the complete staff of officials and directors will be announced. It is understood that New York, Boston and Texas capitalists are interested in the project.

The new line will compete with the Morgan line and the Mallory line, now operating between New York City and Galveston, Tex. The two last named companies have heretofore practically monopolized all the Texas traffic originating at eastern cities and points in the interior east.

Major Graham D. Fitch, government engineer with headquarters at Duluth. held a meeting last week to consider the removal of the Park Point dock line. Vessel interests were practically unrepresented. The Commercial Club of Duluth entered a written protest against the plan outlined by the board of engineers. The club objects to the moving of the dock line below Pine street, and suggested that the enlargement of the harbor take place as projected by the board and that the dock line to the south could be left in the same position it is in now. In other words they did not object to the enlargement of the dredged area of the harbor basin but they object to the alteration of the harbor line below 19th avenue on Minnesota Point.

It is rumored at Portland, Me., that the New York, New Haven & Hartford railroad will soon operate and maintain a new steamship terminal in that city.

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The Right-of-Way of the Great Lakes*

BY F. C. SHENEHON, MEMBER OF THE DETROIT ENGINEERING SOCIETY.

Mr. President, Gentlemen: Any device for transporting passengers, commodities or freight has, of necessity, two essential correlative parts,—the carrier and the track. In the case of a water route, the tracks may be infinite in number, and the locus of these tracks may be called, for lack of a better term, the *right-of-way,* after the analogy of a railroad. The great lakes, viewed as the right-of-way of a transportation system, is my subject tonight.

There are a great many structures on the Lakes, magnificent ship locks, canals and canalized rivers, splendid breakwaters and harbors, docks and terminal devices for the rapid handling of cargoes. The right-of-way is planted with lights and buoys to guide the vessels, and the vessels themselves and the commerce of the lakes are worthy of many papers. It is hoped the discussion will develop some things concerning these, but in *this* paper it is purposed to deal with the naked right-of-way of the grea lakes—the basin, the water, the property and its engineering administration — and to touch on some of its problems.

The total water area of the great lakes is 95,645 square miles, and this includes the interlake rivers and the St. Lawrence river so far as it marks the international boundary. Lake Superior, with its 32,060 square miles of surface, is a third of the whole; Michigan takes 23.3 per cent, Huron 24.3 per cent, Erie 11.1, and Ontario 7.8 per cent.

Nearly two-thirds of this area, or about 62,000 square miles—which is roundly the area of the New England states—lies on the American side of the boundary.

The vitality of the lakes comes from a watershed of 192,600 square miles, the whole drainage area—that is, watershed plus water surface—is 288,245 square miles. The surplusage of water which flows down the St. Lawrence river and ultimately debouches into the ocean is over 250,000 cu. ft. per second.

The mean surface of Lake Superior is 602.31 ft. above the level of mean tidewater in New York harbor. In St. Marys river a descent of 21 ft. is made, about 19 ft. of this being in the rapids at Sault Ste. Marie. This brings us to Lake Huron. Out of this Lake Michigan opens through the level roadway of the Straits of Mackinac, and because these lakes are simply two lobes of one level body of water connected with a bypass, it is not uncommon to speak of them as a unit hydraulically — Lake Michigan-Huron.

From Lake Huron down to Lake Erie is two steps, one of 5¾ ft. in St. Clair river to Lake St. Clair, and a second of 3 ft. in the Detroit river to Lake Erie—still 572.60 ft. above the sea.

From Lake Erie to Lake Ontario the descent in the Niagara river is 326.42 ft., and 160 ft. is sheer fall over the cataract.

The St. Lawrence river, during the 110 miles of its course as a boundary stream, makes a descent of 94 ft. from the level of Lake Ontario.

Summing up the several steps from Lake Superior down to St. Regis shows a total descent of 450 ft., with the river still 152 ft. above the Atlantic ocean.

Lake Superior has an axial length of 382 miles, with a maximum width of 160 miles, and depths as great as 1,000 ft.; Michigan is 345 miles long by 118 miles wide, with 870 ft. maximum depth; Huron, 265 miles long by 146 miles wide, with 750 ft. maximum depth; Erie, 250 miles long by 57 miles wide, with 210 ft. maximum depth; Ontario, 202 miles long by 53 miles wide, with 738 ft. maximum depth.

Now these great fresh-water basins differ from artificial reservoirs mainly in their splendid scale. Despite their bigness they are simply reservoirs, and to a considerable extent at the present time they are artificial reservoirs; that is, the natural surface levels have been changed—raised or lowered—by engineering works in the outflow rivers, or by the creation of artificial independent outlets. And these interferences with the surface levels exist on each of the lakes, and, except in the case of the Lake Superior compensating works, they were not intended to produce the effect which has come from them.

It is expected to show later that engineering works' specifically designed to control the outflow and fix the lake surface levels at desirable stages must eventually supersede the present mongrel condition. By *mongrel* I mean neither purely natural nor purely artificial.

Well, each lake is impounded, and its level fixed primarily by a natural barrier in the outlet. For Lake Superior, ledge rock—Potsdam sandstone—forms a dam, a submerged weir in St. Mary's river. At the crest of the weir, which is at the head of the rapids, the water runs crystalline clear over the clean ledge rock. I speak of this crystalline quality of the water not for picturesque effect, but because this very clearness of the swift water is an element in the permanence of the dam. The lake above is a settling basin, so the water rarely carries any sediment, and the dam is saved the fierce and incessant bombardment of minute particles characteristic of sedimentary streams. The downstream slope of this natural dam is rock in place strewn with glacial drift, forming the bed of the rapids—with a descent of 19 to 20 ft. in ¾ of a mile. The rapids at the "Soo" have the effect of a sheer fall, and backwater from Lake Huron has no retarding influence on the outflow of Lake Superior.

Lake Michigan-Huron is held primarily in check by a constricted outflow section at Port Huron, a *gut* over 60 ft. deep by 700 ft. wide, and this is reinforced by the inertia of the St. Clair and Detroit rivers. The hydraulic conditions existing in this wasteway are somewhat complicated. Considering each of the lake outflows, however elongated, as a submerged weir, the St. Clair-Detroit river weir has a downstream slope length of 85 miles. In spite of this great length, the efficiency of flow is affected by the tail water. That is, backwater from a high stage of Lake Erie at Amherstburg retards the outflow of Lake Huron at Port Huron. It is not difficult to credit this, because the fall between lakes is only 8¾ ft. That 8¾ ft. is the potential needed to maintain a certain volume of flow. Should Lake Erie rise 3 ft., only 5¾ ft. remains, and that 5¾ ft. of fall could hardly be expected to do the work accomplished by 8¾ ft. before.

Lake Erie is impounded primarily by a limestone bed rock ledge or submerged weir at Buffalo, but, as in the case of the St. Clair river, this is dependent for its efficiency on the inertia, resistance or backwater in the river below, reaching here for 20 miles to the rapids above the Cataract at Niagara Falls. The ledge rock at

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the head of these lower rapids, forming a second submerged weir, reinforces, by backwater effect, the initial submerged weir at the head of the river. As the river descent between these two weirs is but 10 ft., it is easy to understand the correlation of the weirs.

Lake Ontario finds the barrier which restrains it at the Galop Rapids, 67 miles down the St. Lawrence river, where a submerged weir of sandstone exists. From the point of view of hydraulics, this 67 miles of placid river flowing leisurely through the Thousand Islands must be considered as an arm of the lake, even though in this reach a descent of 2 ft. is made.

The Galop Rapids has a fall of 8 ft. in one mile, and the weir discharge is not affected by backwater in the lower river.

I have explained the construction of the waterways of the basins of the lakes in some detail because the integrity and the betterment of the right-of-way hinges on them.

Now it has been estimated that if Chicago should be given 14,000 cu. ft. of water per second which she wants for the drainage canal, Lake Michigan-Huron, Lake Erie and Lake Ontario, and all the rivers from St. Marys below the locks, down into the St. Lawrence, would drop somewhere in the neighborhood of 8 or 9 in. This 8 or 9 in. means much or little only as it scales on the measuring stick of dollars, and this leads to a brief discussion of the commercial use of these reservoirs and connecting rivers, which form the right-of-way of the great lakes.

You will remember that La Salle in 1679 built the Griffon, the first ship to sail Lake Erie, and that it shortly vanished into thin air. A part of the navigators of those days were missionaries interested in saving redskins; but some of them were more interested in saving beaver skins, and most of them had their hands full at times saving their own skins. These voyageurs, missionaries and fur traders, with their canoes and bateaux, had little thought of *aids to navigation*, yet at Sault Ste. Marie, on the Canadian side, just 110 years ago, they were building a lock to facilitate the climb of the rapids, and in 1850 a tramway portage was built on the American side. The authorized charge on this tramway for getting freight past the rapids was 5 cents a hundred pounds, or $100 per ton. While this charge as a mile-ton rate is more than 1,000 times that of average lake freight rates at the present time, it was not for this reason solely, nor the delay, but because, in addition, vessels were needed on Lake Superior, that a ship lock was wanted at Sault Ste. Marie. The agitation for a ship lock preceded 1840, in an attempt to get from congress a land grant to enable the state to build a lock. This land grant was secured in 1852, and the ship lock was completed in 1855, with chambers 70 x 350 ft.; the canal draught was fixed by the terms of the land grant at 12 ft.

The principle that the general government had any *right* to expend money on streams subject to interstate commerce was not entirely accepted even in 1855; but in 1856, under the somewhat facetiously accepted doctrine that the improvement of these channels would assist a naval movement, and could therefore be construed as a war measure, appropriations to secure 12-ft. draught in St. Marys river were passed over President Pierce's veto. The opening of the lock at the "Soo," and this dredge work in St. Marys river, and that in St. Clair flats, gave nominal 12-ft. navigation between Duluth, Chicago and Buffalo; and this dredge work in particular marks the full assumption by the general government of the burden of improving, maintaining and operating the right-of-way of the lakes as an interstate highway. State sovereignty was more keenly felt in those days, when men who had known actual state independence were still alive; and it was only a few years before the Rebellion, a war in which *state rights* was the issue.

I am not sure that the relative activities and jurisdictions of the states and the nation in the waters of the great lakes are entirely clear. The general principle, however, as I understand it, is this: In Lake Huron, for instance, the state of Michigan extends out to the international boundary; the state holds the title to the submerged lands in fee; the nation, on the other hand, holds jurisdiction over these waters, from the meander line out, for purposes of navigation, and as a boundary stream or lake. The exact demarcation of the respective rights growing out of these overlapping jurisdictions is not always obvious. As an instance, at Niagara Falls a certain power company has claimed the right to divert water from the Niagara river under a New York state permit; and it has been argued likewise that the state of Illinois has the right to divert the water of Lake Michigan. The government, however, reserves the right of interference with the navigable integrity of interstate waters or of waters defining the national boundary, and this reservation has even a broader international signification.

An inland lake or river contained wholly in one state, with no navigable connection leading to a second state, is not an interstate waterway; and in such a case the general government has no jurisdiction whatever. Even federal laws regarding steamboat inspection do not apply.

It is not purposed to follow the history of the development of the artificial channels, or of the harbors of the lake system. The locks at Sault Ste. Marie have, since 1855, set the draughts and limited the vessel dimensions. The steps are these: 1855, Old State lock, 10-ft. draughts; 1881, Weitzel lock, 14½-ft. draughts; 1896, Poe lock, 20-ft.; some time in the next five years, Davis lock, 24½-ft., or greater, draughts.

You will observe that the old state lock, which was built for 12-ft. navigation, shows only 10 ft. of draught in this series. If it had been in existence during the past season it would have had little over 10 ft. on its lower sill, and this is because the lakes were higher half a century ago.

Even prior to this state lock of 1855 vessels of 500 tons navigated precariously on 12-ft. draughts as far as the "Soo," and 12 ft. was available in some harbors; but when the lock was once built, that became the standard, channels and harbors worked to the lock draught, and vessels were built to fit these channels and harbors.

Later, the Weitzel lock, built in 1881, for 14½-ft. draughts, set harbor and channel depths; and in 1896, the Poe lock, with 20 ft., became the standard for the channels connecting Duluth, Chicago and Buffalo, and this is in operation now, but with draughts little better than 19 ft.

Our president can speak with authority of the splendid works at the "Soo," and of the canalization of St. Marys river, and that of the St. Clair river as well; and Mr. Dixon with authority on the lower Detroit river, and Colonel Davis on both. These are the critical places in the navigation of the lakes. For the most part artificial channels are at least 300 ft. wide, with greater width on curves. In rock cuttings, and where exposed to a seaway, they have at least a foot greater depth than elsewhere. Alternating channels, one for up-bound and one for down-bound boats, are replacing single constricted channels at the Neebish, at the flats and in the Detroit river. The danger of blocking single channels by collisions has be-

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come too great and too costly, as a day's navigation of the lakes is worth a quarter of a million of dollars in freight charges.

Taking the Detroit river traffic as 84½ per cent of the lake tonnage, the blockading of the lower Detroit river, by sinking a vessel across the channel, would entail a loss of $200,000 a day, in addition to the loss to the damaged vessels. The alternating channel diminishes this great risk.

The commerce passing the "Soo" locks, that up to the breaking out of the civil war, had shown a maximum of 153,721 net tons, has now, in 1907, grown to the great aggregate of 58 million tons, 377 times the volume of the ante-bellum commerce.

Estimating, by the ratio of 1906, between the traffic passing the "Soo" locks and the total traffic, shows the domestic lake commerce of 1907 to be 85 million net tons, having a valuation of 883 million dallars. The freight charges on this at 66 cents per ton amount to 56 million dollars.

Now, if the ore and coal and grain and lumber and other commodities transported on this right-of-way had been moved by rail, it would have cost not less than three times as much, and the saving in freight charges is, therefore, 112 million dollars for the year; and, as a penny saved is a penny earned, this 112 millions is the earning, the dividend, distributed to the people of the nation as stockholders in this co-operative transportation system.

At the present time our railroads are inadequate to the needs of shippers, even without the additional burden of the vast freight volume of the lakes. James J. Hill is quoted as saying that in the past few years mileage of track has increased 22.7 per cent, and traffic 126.4 per cent. If the Lake Superior ores depended on rail shipment it is doubtful if the nation's supremacy in the world's steel industry would exist. You will remember in the cases in which Judge Landis inflicted the 29 million dollar fine, the published freight rate on oil was 18 cents, while the Standard Oil Co. paid 6 cents. The advantage of the octopus of a freight rate of one-third the going rate is the same advantage our steel industries enjoy—compared with their condition without the right-of-way of the great lakes.

Now this right-of-way, regarded as a property, has a certain value, and it will be of some service to approximate this, because on property worth a hundred dollars an acre you might be warranted in making certain expenditures for surveys or improvements not warranted on property worth one dollar an acre. If the government did not own the lakes, and could not use them otherwise than by purchase, how much would it be warranted in paying for them? The government can borrow money at 2 per cent. Capitalizing the earning capacity of 112 millions at this rate shows a present value of 5,600 million dollars for the right-of-way. And the profits on this purchase price would come in with a 10 per cent annual increase of valuation, in the fisheries, in water powers, and in such subsidiary uses, as for parks, reservations, and for sanitation, as at Chicago.

There are about 40 million acres on our side of the boundary, and each acre is, therefore, worth $140—which is more than the value of farm land in Michigan. As the United States government up to the present time has invested less than 100 million dollars in improvements on the great lakes, the total expenditure per acre is less than $2.50; and the present yearly earning capacity is about $2.80 an acre; so the yearly earning is in excess of the total investment in improvements. The surplus earnings of three or four years of the great lakes transportation system will pay for the Panama canal. It may be of interest to add that private and corporate interests are credited with a holding of about $150,000,000 in vessels and terminal facilities.

A right-of-way of such importance, such extent and such value, is worthy of a competent engineering organization to explore, improve, maintain and operate it. You are aware that all public works relating to navigation, including the Panama canal, are in the hands of the corps of engineers of the army, under the big war secretary, Taft. I am not certain, however, that every one is familiar with the genesis of an engineer officer of the corps. They are all West Pointers, and the top men of each class; sometimes the four top men; this year the nine top men. The second-best men may go into the artillery, the next into the cavalry, and the bulk into the infantry. The engineer officers are, therefore, picked men. After leaving the academy they take a couple of years in post-graduate work in engineering before entering active service. The chief of engineers has his headquarters at Washington, and is appointed by the president from among the ranking colonels.

For adminstrative purposes the lakes are divided into seven geographical districts, each with an officer of the corps of engineers at its head, and these officers, as I have said, have charge of all river and harbor improvements and of the operations of all locks and canals.

Beginning at the east end, the first district, under Colonel Fisk, of Buffalo, includes the St. Lawrence river; all Lake Ontario harbors, including Charlotte and Oswego; Niagara river; and on Lake Erie, Buffalo, Dunkirk and Erie harbors. The second district, under Colonel Townsend, of Cleveland, takes in all Lake Erie harbors west of Erie, including the important harbors at Conneaut, Ashtabula, Cleveland, Sandusky and Toledo. The third district, under Colonel Davis, of Detroit, includes the Detroit, St. Clair and St. Marys rivers, Lake St. Clair, and all Lake Huron harbors, including Cheboygan in the Straits of Mackinac. The big works at the "Soo" and the channels in Hay lake and at the Neebish and in the lower Detroit river, make this district a heavy one. The fourth district, temporarily under Major Keller, with headquarters at Grand Rapids, has jurisdiction over the rivers and harbors on the east shore of Lake Michigan from Michigan City up. The fifth district, under Colonel Bixby, of Chicago, includes the important works in the south end of Lake Michigan, and some of the rivers and canals extending inland. The sixth district, under Major Judson, of Milwaukee, contains the rivers, harbors and canals on the west shore of Lake Michigan from Waukegan northward; and the seventh district, under Major Fitch, of Duluth, takes in all the rivers and harbors of Lake Superior.

Now these seven engineer districts are engaged mainly in work relating to artificial channels and terminals,—that is, to *rivers and harbors.* Outside of the rivers and harbors are the open lake areas, the big right-of-way of the lakes, with its intricate mesh of vessel tracks. In these the United States Lake Survey works. It is the engineering staff-at-large, dealing with the lakes as a unit, as a single transportation system. While the district engineer is concerned with the needs of his own district—and there is enough work in each district to keep an officer busy—the Lake Survey handles the large questions of lake levels with a view to their regulation, all extended surveys, soundings and sweepings, all magnetic surveys for compass variations, all charting of the lakes, and systematic notices to

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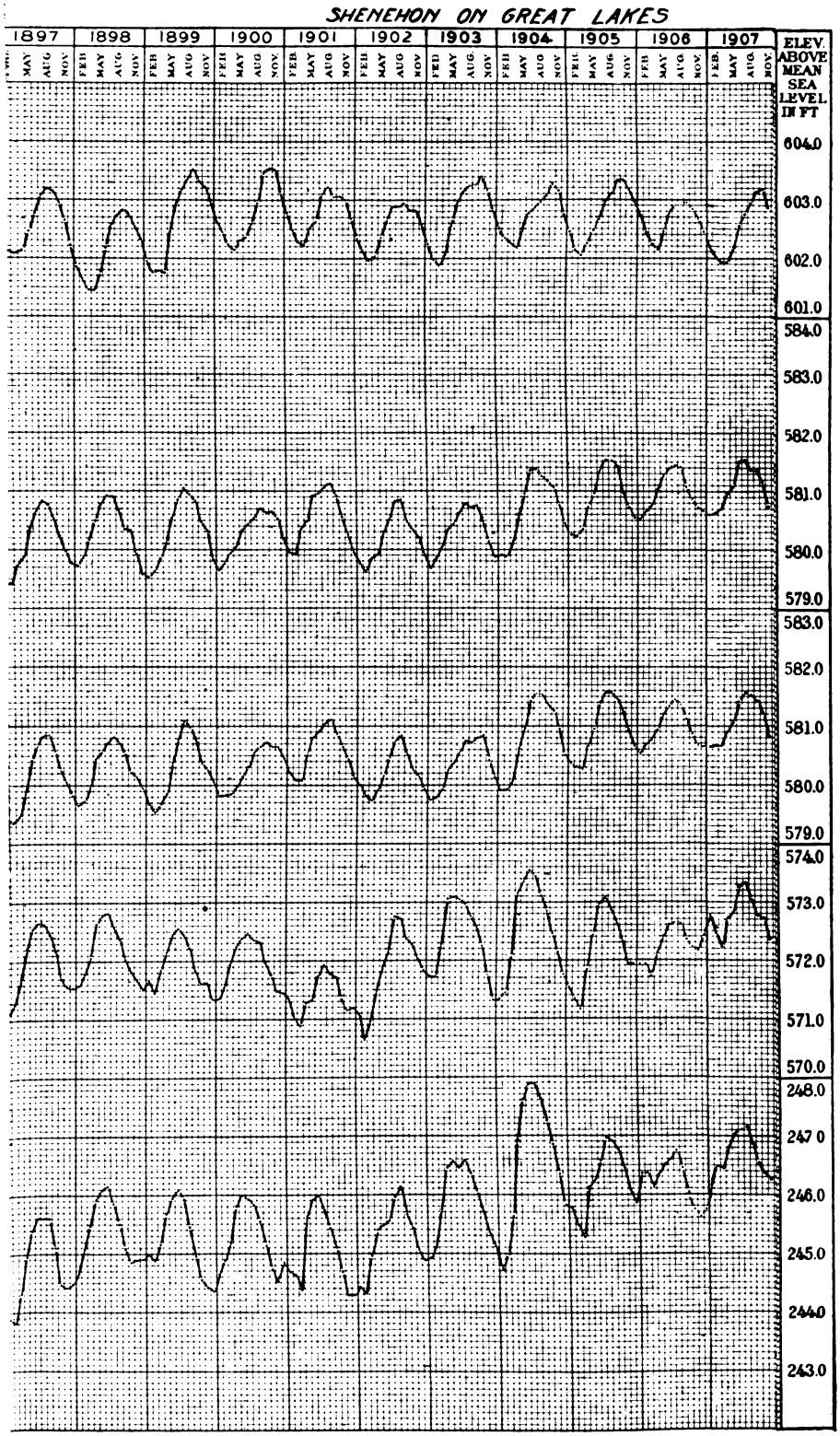

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mariners of changes affecting navigation—in short, the things that concern the lakes as a whole and are vital in the operation of this great transportation system. The jurisdiction of the Lake Survey corresponds to that of an eighth district extending over the whole lake region, overlapping, embracing and co-ordinating with the seven other districts, and reaching into every river and harbor. But it has nothing to do with dredge work, it does not build locks or breakwaters. The Lake Survey is under Major Charles Keller, of the corps of engineers.

The officers of the corps correspond to chief engineers in civil practice, and they are aided by civilians—in the highest rank called assistant engineers, with the prefix principal for the ranking assistant.

The government service is attracted on account of the magnitude of the works and problems. The work is larger than two by four.

Among the public works of the United States the Panama canal ranks first in importance, New York harbor second, and Detroit third. Our president is principal assistant engineer of the Detroit office, and Mr. Dixon is in local charge of the six-million-dollar Detroit river improvements in the vicinity of Amherstburg.

The Lake Survey also has some big problems that are attractive. Of course the Lake Survey, because it covers seven engineer districts, ought to be more important than Panama, New York or Detroit, but I cannot convince some people that this is so. However, it is important enough to warrant my saying something about it.

The Lake Survey began work in 1841, and, except for suspended animation for a single year, has existed ever since. A part of the time it has barely existed. It is rather remarkable that the concentration of energy and the straining of resources to meet the crisis of the war of the rebellion did not interfere with the prosecution of the Lake Survey. On April 12, 1861, Fort Sumter was fired on. In the preceding March the Lake Survey appropriation was $75,000. The succeeding years show appropriations as follows:

1862	$105,000
1863	106,879
1864	100,000
1865	125,000

It may be that the surveys of the frontier had a military significance, growing out of the possibility of international complications.

In 1866, after the war was over, and the nation felt poor, the appropriation dropped to $50,000, but by 1868 it had grown to $152,500, and remained at a good figure until the winding up of surveys in the late seventies. Then the survey slept on a trifling annuity of two or three thousand a year until 1889, when a mild eye-opener of $7,000 was received. By 1893, with the Poe lock building at the "Soo," and deeper-draft navigation in sight, a $27,000 appropriation was made; by 1898 this was $28,000, and in 1900 it had grown to $78,000. From that on the renaissance has been in flower, with appropriations reaching as high as $150,000 a year. The present project contemplates an expenditure of $125,000 a year for 12 years—a million and a half in all.

The reason for the rebirth of the Lake Survey is the tremendous development of lake commerce. This has been accompanied by an increase of draughts—with 24½ ft. or more to be available in the new "Soo" lock five years from now. The present importance of the lake vessels requires closer surveys and developments to greater depths, and submarine searches by modern sweeping methods instead of the lead-line work of our ancestors. And the hydraulic questions having to do with the preserving of the lake levels have become correspondingly important. The lake survey issues navigators' charts of the lakes, 119 different ones in all. The artistic excellence of these charts is largely due to Assistant Engineer Edward Molitor.

The information service of the survey is an important branch. We issue a yearly bulletin full of everything pertaining to the lakes that might be of use or interest to navigators. We issue monthly magazine supplements, and issue to the press all over the lakes special notices of new discoveries of shoals, wrecks, derelicts, new harbor depths, new channels, dangers and aids. For survey work we have five steamers and employ, when running full tilt, from 150 to 200 men.

The geodetic work of the old lake survey is a classic and that of the new lake survey is a second volume, but to my mind the hydraulic work of late years, having in view the betterment of draft conditions by artificial control of the efflux, has a fuller interest.

It has been estimated that a change of a foot of draught in one of the large lake carriers will make a load change of 10 per cent of her 19-ft. draught cargo-carrying capacity. That is, a vessel carrying 10,000 tons of ore on 19-ft. draught will carry 11,000 tons on 20-ft. draught, and 9,000 on 18-ft. draught, while the operating expenses will change very little between 18-ft. and 20-ft. draughts. Were all the vessels of the lakes loaded down to 20 ft. instead of 19, the cargo, which now costs 56 millions to move, would be moved with a saving of four or five million dollars a year.

It is because every inch on the big carriers means 50 to 80 tons of cargo that owners load to the limit. In the "Soo" locks the government had to build breast walls to keep vessels off the miter sills and had to measure up their draught to prevent grounding and delay in the locks. It is for this same reason that vessel interests look with resentful eyes on the proposition to divert 10 to 14,000 cu. ft. down the Mississippi valley through the Chicago drainage canal. This must appear to them a last insult. But this loss of 8 or 9 in. of draught, even though it cost a million or two dollars a year in increased freight charges, is trifling compared to the loss coming from the regime of low lake stages. Whatever the cause of low water may be, it is a fact. In Lakes Michigan-Huron and reaching up St. Marys river to the lower entrance of the "Soo" locks, in the St. Clair and Detroit rivers and in Lake Erie it exists. Lake Superior is all right, and Lake Ontario may get even uncomfortably high. I will speak later of the reasons why these latter lakes are well up.

Colonel Davis, in his reports on the 20-ft. channel, has for several years past reiterated—like the *Carthage must be destroyed* of the Roman senator—this statement: "The improved channels were made available in 1897, but as the water levels have been *almost continuously below the mean stage*, the actual navigable depth has been 1 to 3 *ft. less* than 20 ft."

Remembering that a change of 1 ft. draught on the big carriers means 10 per cent of load, the 3 ft. lost mean over 27 per cent of the cargo-carrying capacity destroyed; so that freight which should cost $1 a ton on 20-ft. draught, costs on 17-ft. draughts nearly $1.37; and as the consumer generally pays the freight, you and I pay more for bread and coal and lumber and steel and every product into which these enter, on account of low water.

Not all the vessels of the lakes could load to 20 ft.—some of them are light draft—but any figures that deal with 10 or 20 years in the future may assume that the bulk, the big percentage of the freight, will be transported in vessels capable of deep-

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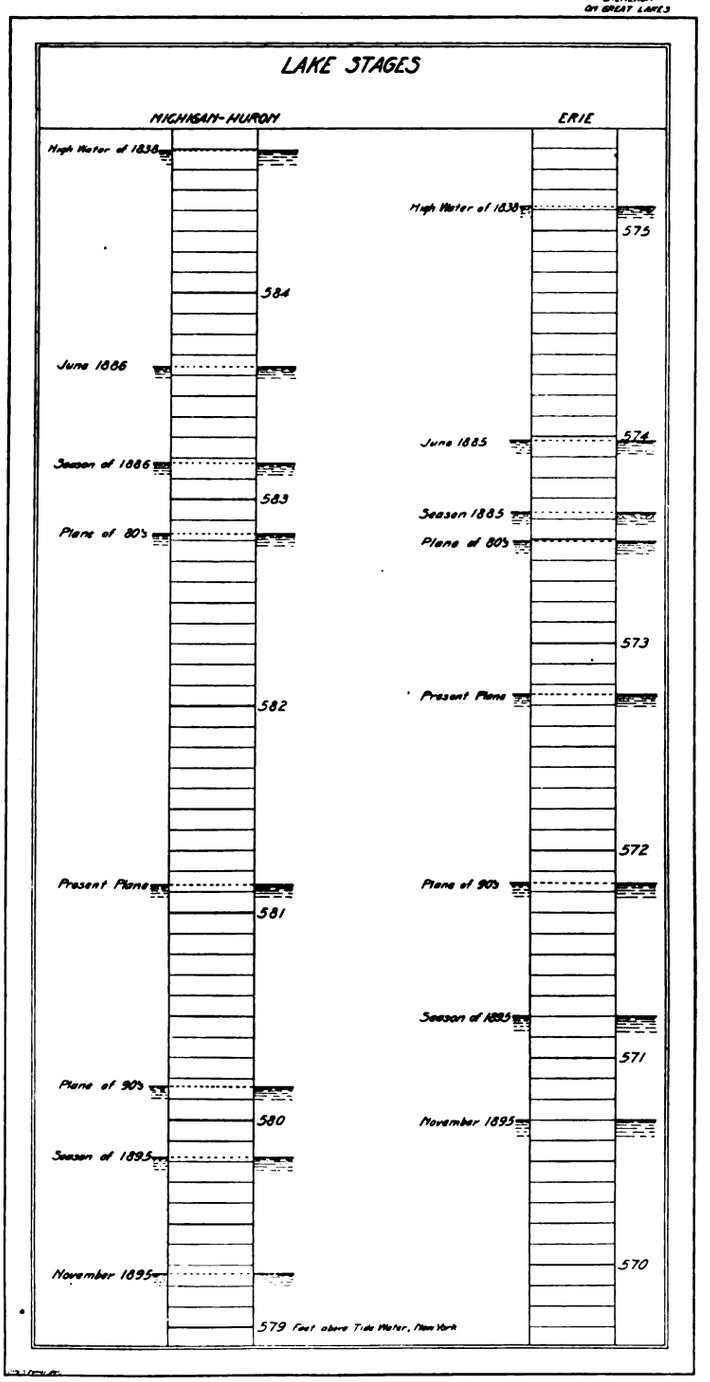
draught loading—and subsequent figures will rest on this assumption.

Taking up Lake Michigan-Huron first, and remembering that the level of water in the lake affects the St. Marys river to "Soo" locks, and the St. Clair river, the mean elevation during the seasons of navigation for the 5 years, 1883-1887 (I shall speak of this as the *plane of the '80s*), was 582.8. It was considerably higher than this part of the time; 9½ in. higher during June, 1886, and 4 in. higher as a mean for the season of navigation of 1886. Plate 1 illustrates these levels.

Since this good lake level existed as a *state of nature* for five years, and only 20 odd years ago, a *return* of the lake to this level could not cause shore encroachments that might be logically resented or resisted; and as engineering works of importance have been constructed with a full knowledge that a series of wet years may bring the lake back to this prior level, no damage should result. What is known as the *high water* of 1838 was 23 in. above the *plane of the '80s*. During the past season the mean stage of the highest month, July, was 15 in. below this *plane of the '80s*.

PLATE NO. I



Now I do not wish to commit myself to any particular lake level as the right level—I am discussing the principle rather than definite limits—and this *plane of the '80s* is a convenient and defensible illustration.

From 1895 to 1899 was a five-year period of low water; I shall call the mean level during the seasons of navigation of these years the *plane of the '90s*.

This *plane of the '90s* is for Lake Michigan-Huron 2.6 ft., or 31 in. below the *plane of the '80s;* and in the season of 1895 the water was 3 ft. below the *plane of the '80s*. In November, 1895, it was 4.4 ft., or 53 in., below the level of June, 1886. That is, between *planes of the '80s,* and *the '90s* there is 2.6 ft.; between extreme years, 3 ft.; between extreme months, 4.4 ft.

For four years now the level during the season of navigation has been much the same as during 1907; I shall call this the *present plane*. It is 1.7 ft. or 20½ in. below the *plane of the '80s,* with a loss of 14 per cent in the carrying capacity of the heavy freighters, or 1,400 tons loss for each trip of a big carrier.

For Lake Erie the *plane of the '80s* is 573.5, and that of the '90s is 1.6 ft., or 19 in. lower; and during the season of 1895 the lake was 2.3 ft., or 28 in., below the *plane of the '80s* and the change between single months is over 4 ft., as on Michigan-Huron. The *present plane* is only 9 in. below the *plane of the '80s*. This good stage of Lake Erie is likely to retard regulation, because it is not uncomfortably low; but the recurrence of the low water of 1895 is very certain, with a loss of carrying capacity of over 20 per cent as compared with the *plane of the '80s*.

Please do not think I speak as a discoverer of the regulation of lake levels. Roosevelt, you know, is charged with having discovered the Ten Commandments, but Moses had a whack at them some centuries before. Regulation is not quite so aged or quite so urgent as some, at least, of the Ten Commandments, but it is very far from new. The need of it was recognized fully in the early '90s, and the low water of 1895 brought the discussion to an acute stage. In

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1898, the late George Y. Wisner, past president of this society, as a member of the deep waterways commission, urged the building of controlling works in Niagara river. In this project Lake Michigan-Huron was to receive its benefit by back-water effect only. It was estimated, as I remember it, that a rise of 3 ft. in Lake Erie would raise Lake Michigan-Huron 1 ft.

At the present time another of our past presidents, Dean Haskell, of Cornell, as a member of the international waterways commission, is working anew on the problem of controlling works in the Niagara river.

The lake survey's part in these investigations, so far, is to gather the physical data, water levels, river flow, evaporation, and make studies of rainfall and the like.

Though this question was acute, as I have said, during the low water of 1895, it has been growing vastly more important since, because the traffic is nearly *four* times as great now as in 1895.

What are the *causes* of this *low water regime?* Take Lake Erie, for instance: In order to get a navigable channel down the Niagara river to Tonawanda, dredges and drills have gone in and breached the natural dam; the Erie canal and the Welland canal take some water for navigation and some for power purposes. The power companies at Niagara Falls are suspected of having something to do with draining Lake Erie, and the lake survey has their case under consideration of the present time, but with no decision announced. Whatever water goes down the Mississippi valley through the Chicago drainage canal is at the expense of Lake Erie. It is possible that deforestation of the shores and the plowing of the land have lowered the run-off by increasing evaporation, and are contributory causes.

Variations in rainfall and evaporation account for periodic low and high water. Each season the lakes rise with the early summer rainfall and run off, and fall as the days grow drier. The seasonal curves are shown in Plate 2. This movement would be much reduced by controlling works.

If it be done *brutally,* it is exceeding easy to raise the level of one of the great lakes. Lake Superior, the biggest of all, was raised 6 in. by bridge piers and a wing dam at the head of the rapids in St. Marys river. The cross-sectional area of the outflow at the crest of the weir was reduced, and Lake Superior had to rise to get its normal outflow back again.

Lake Ontario has been raised 5 in. by plugging up, in 1903, a small part of the outflow at the Galop rapids.

I say this method of getting better navigable depths is *brutal* because it increased the seasonal movement, and reduced the power to regulate against *high water.* It lacks finesse and foresight. Lake Superior has, since the building of her power canals, avoided any possibility of destructive high water, but Lake Ontario may experience the discomforts, if not the dangers, of high water. December, 1907, shows for Ontario the highest water for that month since 1876.

The *danger* of a lake that in masquerading as Mr. Hyde cannot go back to Dr. Jekyll, in its destructive possibilities does not need to be dwelt upon. We want in the lakes a condition of comfortable fullness, not *intoxication* nor the *orgies* that may accompany a debauch. It is because of this danger of overfullness that the first move in lake regulation needs to be for bigger outflow capacity than nature provided. You cannot regulate against high water otherwise. Back in the early '90s our president, Mr. Wheeler, gave out this principle, and I believe it to be fundamentally sound. There are some corollaries to this proposition, regarding independent outlets, that Mr. Wheeler may wish to speak about.

How are the lakes to be regulated? What form of controlling works? That is too large a subject to enter upon at this time of night.

Nature has a method of regulation that is excellent, so far as it goes. In the cold months—January, February, March—ice in the St. Lawrence river checks the outflow, and the average depth of water impounded by this winter regulative force is 7 in. on the surface of Lake Ontario. In the St. Clair river ice jams occur, and the outflow is reduced at times from a normal of 200,000 cu. ft. to 74,000. L. C. Sabin, a member of this society, computed the impounding value of ice in St. Clair river in 1901 as over 6 in. on the surface of Lake Michigan-Huron.

When the spring comes these controlling works of ice go out, and not a vestige of the apparatus remains. The channel has returned to its full unimpeded capacity. If these ice jams were placed only when *needed,* and kept in place as *long* as they were needed to accomplish the desired results, the system would be perfect. In the end engineers must take their cue from nature in this, but not to the extent of using ice jams—dams or caissons rather, to reduce critical areas, as flashboards reduce the outflow area of a milldam.

I feel sure the *reinstatement* and *upholding* of the lake levels will come; that the caprice of nature will be superseded by human foresight. I believe it is a worthy engineering project. The water of the lakes is too valuable to run off without yielding up the full good that is in it. It is needed for vessel tracks, for sanitation and for scenic grandeur and water powers, as at Niagara Falls. There are 5,000,000 H. P. in the vicinity of the cataract at Niagara.

I spoke before of the vitality of the lakes coming from the water. Low water is disease. The lakes were sick in the '90s. The present semi-strength is only a rally, not convalescence. The bleeding must be stopped before the patient will know again the fullness of health, and here is a chance for engineering medication.

The spectacle of the volume of commerce grown to tremendous proportions—it is more than a third of the national commerce—while the tracks have dropped down to *inefficient levels,* is not a pleasant one. The process of dredging the bottom to keep pace with falling surface levels is a tedious and costly *stern chase.*

It is a much better proposition to uplift the lake levels and let the water at one stroke come pulsing back into every harbor and channel, restoring and retaining fullness of the '80s. That will mean good roads on the right-of-way of the great lakes.

Now, in closing I want to say that the steamer track from Duluth to Buffalo is 985 miles long; and the length of this paper is about the same. I thank you for your patience; I can excuse myself only as Tom Reed did when accused of running a billion dollar *congress.* He said; "This is a *billion dollar country*"—and my paper tonight is on a 985-*mile subject.*

It is announced that the steamers of the Pittsburg Steamship Co.'s fleet are to be equipped with Lyle guns. This gun is employed in all life saving stations in throwing lines to stranded vessels. While opportunities for its use aboard freight vessels are fortunately rare, still occasions have occurred wherein loss of life might have been prevented had such a gun been available, notably the case of the Mataafa which broke in two outside of Duluth harbor, two years ago, leaving the men in the after end of the boat helpless.

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BOSTON MARINE NOTES.

Boston, June 24.—Of late the coal freighting situation at the port of Boston has been one of much concern to owners of the large fore and afters.

The five-mast schooner Governor Ames—the first five-master ever built—is still carrying coal cargoes at $1.10 a ton, while many other vessels are unable to get a charter at any price. This is accounted for by the fact that the Governor Ames is operating on a year's charter, but this expires in July. The vessel carries 3,000 tons of coal and until her present charter expires no time will be lost in making trips at $1.10, while other vessels whose owners some time ago refused to enter into contracts for 95 cents a ton freight money would now willingly accept cargoes at 50 cents. As the year's contract of the Governor Ames expires in July the owners will then be confronted with the same proposition that owners of other sailing vessels are up against, who have preferred to place their vessels out of commission, understanding that it would be cheaper to pay wharfage than to keep their craft in commission, carrying coal for less than 50 cents per ton, out of which running expenses must be met, together with crews' wages, the captain's salary and other necessary expenses.

As an example of the present condition of the coal freighting business in this vicinity, the five-master Davis Palmer left Portland, Me., recently after waiting 82 days for a charter and then accepted one at 50 cents per ton from Norfolk to a New England port. This is about one-half the usual rate. Another vessel of the same fleet, the Harwood Palmer, has been at Rockland, Me., since Feb. 1, awaiting a charter.

Vice President Byrnes of the New York, New Haven & Hartford railway, speaking recently on the coal carrying situation, had the following to say: "It seems to me that the general public is for lower rates. There is a drift along the line of low rates. There is great inequality of rates in New England. This is because of differences in rates when the many railroads of New England were united. I believe it is possible by a modern system of colliers, by a modern system of loading and unloading, to cut in half the rate of bringing coal from southern ports."

With the entering into the coal carrying trade of the two modern colliers Everett and Malden, built by the Fore River Ship Building Co. for the Massachusetts Steamship Co., it is not at all unlikely that the statement made by Mr. Byrnes will prove true. It seems to be the general opinion among officials of the large coal companies and sea-going men all along the coast that the day is not far distant when modern colliers such as the Everett, Malden and Melrose will entirely displace the large fore and afters, and the barges and tugs now engaged in this traffic.

Soon after completion, the Everett was chartered to the Davis Coal & Coke Co. and the Malden to the Consolidation Coal Co., both of Baltimore, for a period of one year. The Melrose, although designed especially as a collier, has been chartered to the Union Sulphur Co. of New York for one year to transport sulphur from Sabine Pass, Tex., to New York, and after her sulphur charter runs out it is probable she will join her two sister ships in freighting coal between southern ports to ports on the New England seaboard.

Going and coming in all kinds of weather, the Everett and Malden make regular trips between Boston and Baltimore, carrying 7,500 tons of coal cargo, making the trip in about 75 hours. The best record up to date for loading coal into a vessel was accomplished at Baltimore recently, when the Malden finished loading a cargo of nearly 8,000 tons of coal in the astonishingly quick time of six hours.

There has been some talk about the Massachusetts Steamship Co. selling these three colliers to the navy department, but unless a fair purchase price is secured for these steamships it is safe to assume they will not change hands at the present time, for recently the New England Gas & Coke Co., which owns largely in the Massachusetts Steamship Co., purchased the coal property of the Federal Coal & Coke Co., consisting of about 5,500 acres of valuable coal land in West Virginia, carrying about 70,000,000 tons of coal. The output of the company at present is approximately 1,000 tons per day, but it is the intention of the new management to increase the same as rapidly as possible until a maximum of 5,000 tons per day is secured, the most of which will be shipped to Boston for the use of the New England Gas & Coke Co.

The United States grand jury on June 15 reported an indictment against the Cunard Steamship Co. for failing to prevent the landing of an alien from one of its steamships recently.

A libel has been entered in the United States district court by the Eastern Fishing Co., of which B. B. Crowninshield is head, against the Dominion-Atlantic Railway Co., owner of the steamer Boston, to recover $19,500 for the loss of the fishing schooner Fame, which was run down and sunk a few weeks ago off the coast of Nova Scotia by the steamer Boston.

The three largest fruit steamers in the world—the Parismina, Heredia and Cartago—for the United Fruit Co., will soon all be placed in commission. The contract for the construction of three ships of 5,000 tons gross was placed some time ago with a Belfast ship yard and already the Cartago has left the builder's yards in Belfast for Port Limon. Some time next month the second will leave the builders, and the month following will see the third and last in commission. It is said that after the delivery of these three boats, the United Fruit Co. will place an order for the construction of two other large refrigerating steamers to meet the requirements of its increasing volume of business.

Stone Horse Shoal Buoy No. 5A, a second class can, located in Nantucket sound, is missing from its station and will be replaced as soon as practicable. The fog signal on Hen and Chickens lightship No. 86, reported out of order May 29, has been repaired and now sounds correctly.

The American steamer Massapequa, formerly of British registry, arrived at this port June 18 from Porto Rico with 35,751 bags of sugar, weighing 8,979,757 lbs., the largest cargo of sugar ever landed here from Porto Rico. The cargo is valued at $363,000.

The bark Mary Barry, owned by Boston parties, has been chartered to load a lumber cargo at this port for Montevideo, Buenos Ayres and Rosario, at the rate of $8.50 per thousand. Although this is a low rate, it shows an improvement over recent figures.

The schooner Tifton, Boston owned, has secured a charter to carry a cargo of railroad ties from Patuxent River, Va., to Boston, at 11 cents per hundred.

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MONTCALM-MILWAUKEE COLLISION.

Commander Spain, Dominion wreck commissioner, has given a decision re the collision on May 7 between the Dominion government's ice crusher Montcalm and the Canadian Pacific Railway Co.'s steamer Milwaukee, which is of general interest. He says:

"From the evidence adduced the steamship Milwaukee, E. Griffiths, master, from London and Antwerp, with a large general cargo, arrived off the port of Quebec on the night in question. All went well up to that time, and as is usual with all ocean steamships, she slowed down and stopped her engines off the ferry wharf to exchange the sea pilot for the river pilot, maneuvering the engines so as to keep the vessel in position, and to counteract the effects of the flood tide. While in this position, the officers in charge observed a steamer, which they afterwards ascertained to be the government steamship Montcalm, coming up rapidly on their port quarter, her green and masthead lights plainly visible. At this time L. E. Bouille, the river pilot, arrived on the bridge of the Milwaukee; the engines of this ship were immediately put full speed ahead (the vessel having lost steerage way, though at no time was she stationary) to proceed on her usual course up the river. The evidence shows that at this time, the green light of the Montcalm was still abaft the Milwaukee's port beam, but she was rapidly overtaking the Milwaukee and passed her till the green light on the Montcalm became obscured from the Milwaukee. The obscuration of this green light was for a very short period, when it came into view again. Immediately this green light was sighted for the second time, the evidence of the master and officers of the Milwaukee goes to show that one prolonged blast of their whistle was given to attract the attention of the Montcalm, and to advise them of their close proximity. This whistle, according to the evidence of the crew of the Montcalm, was not heard on board that ship, but the court considers that it was undoubtedly sounded. The Milwaukee immediately afterwards blew three blasts of the whistle, the orders to stop and go full speed astern being given simultaneously. These orders, by the evidence of the ship's official logs, were carried out immediately, but being a single-screw vessel, the effect was not as prompt or effective as it would have been on a twin-screw vessel, so that almost immediately the vessels came into collision with the resultant damage. Fortunately no lives were lost or any personal injury sustained.

"The Canadian government twin-screw steamship Montcalm, S. Belanger, commander, bound up the river from the gulf, first sighted the steamship Milwaukee when about the end of the Island of Orleans, some considerable distance ahead. She continued on, keeping their relative distances apart, till the Milwaukee stopped her engines to take on the river pilot, when she rapidly approached, and by the time the exchange of pilots had taken place she was only a little abaft the beam, proceeding very considerably faster than the Milwaukee, and when a short distance ahead of the latter vessel (opposite the Allan wharf, their witnesses and their log show) without giving any warning, that is, one short blast, intimating, 'I am directing my course to starboard,' put her helm hard aport to cross to the north shore, going ahead on the port and backing on the starboard engine, clearly proving that she could not have been as far from the north shore as was endeavored to be shown by the evidence, as the distance was so short that she had to be turned quickly. Carrying out this maneuver she fell athwart hawse the Milwaukee, and the collision took place. It appears from the evidence of the Montcalm that it was not until a collision was inevitable that her engines were reversed. The Montcalm being a small vessel compared to the Milwaukee, only 245 ft. long, with twin screws, could, in the opinion of the court, have been maneuvered and turned around in her own length, whereas the Milwaukee, being a large, heavily laden freight vessel with a single screw, could not so easily be controlled.

"Capt. Belanger, in his evidence, states that he was devoting his attention and carefully scanning the wharves on the north shore to go alongside his berth; no proper attention was given to the movements of the Milwaukee, and she was upon them before they really realized the situation. Capt. Belanger states that he considered the Montcalm was six cables' length from the Milwaukee when he ported his helm, evidently not taking into consideration the fact that the Milwaukee was proceeding up the river, with the combined force of a three-knot flood tide and the way acquired from her own engines, which had been put ahead when the pilot took charge, so as a matter of fact when he ported his helm, the Milwaukee must have been very near; further, the whole distance from the ferry wharf to the upper end of the Allan wharf is only about 4½ cables.

"Both the Montcalm and the Milwaukee were well founded in every respect, that is to say, that the board of trade regulations in regard to boats, life saving apparatus and the certificates of the officers, both deck and engineers, were carried out. the master and chief engineer of the Montcalm holding the best certificates obtainable, as also did the same officers on board the Milwaukee.

"The court is of the opinion that the master of the Montcalm was guilty of a very grave error of judgment and careless contravention of the rules of the road, in not more carefully ascertaining the exact position of the vessel which he had so recently passed, and before porting his helm, giving the usual signal and receiving a reply. Capt. Belanger has had 35 years' experience in government service, but the court cannot overlook his want of care in this case, which might easily have caused large loss of life, and therefore suspends his certificate for 12 months from May 7, the date of the accident. The master and officers of the C. P. R. steamship Milwaukee are exonerated from all blame."

HENDONHALL-SAN LUCAR COLLISION.

Sometimes judges have an unpleasant half hour in passing upon the evidence submitted in collision cases. The testimony is herewith related as presented to Justice Bargrave Deane in the collision case of the British Steamship Hendonhall and the Norwegian steamer San Lucar:

This was an action arising out of a collision in the English channel between the West Hartlepool steamship Hendonhall and the Norwegian steamship San Lucar. According to the statement of claim, the Hendonhall is a new steamship of 2,588 tons net, and shortly before 8:20 a. m. on Feb. 12 last was proceeding up the channel to the southward and eastward of the Owers lightship, in the course of a voyage from New Orleans to Rotterdam with a general cargo, manned by a crew of 30 hands. The weather was foggy, with a light air from the E. S. E., and the Hendonhall was making about three knots through the water, with her engines working dead slow, on a course of E ¾ S magnetic. In these circumstances a long blast was heard from the whistle of a steamship, which proved to be the San Lu-

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car bearing about ahead. The engines of the Hendonhall were at once stopped and her whistle was sounded a long blast in reply, and thereafter kept sounding a long blast at short intervals. Several long blasts were also heard at intervals from the San Lucar, and when the Hendonhall had run off all her headway two long blasts in succession were sounded on her whistle. Just afterwards the San Lucar loomed in sight through the fog, about three ship's lengths ahead, whereupon the engines of the Hendonhall were immediately put full speed astern, three short blasts were sounded on her whistle, and her helm was put hard a-starboard. The San Lucar replied with three short blasts, and this signal was repeated several times by each vessel, but the San Lucar came on at considerable speed, and with her port bow struck the port bow of the Hendonhall, doing damage. The plaintiffs alleged that the San Lucar neglected to go at a moderate speed and to stop her engines, and then navigate with caution on hearing, forward of her beam, the fog signal of the Hendonhall, whose position was not ascertained.

According to the defence and counter-claim, the San Lucar is a steamship of 954 tons net, and shortly before 8:45 a. m. on the day in question was between Beachy Head and St. Catherine's Point, on a voyage from Gothenburg to Santa Cruz, Teneriffe, and Las Palmas, laden with a general cargo and manned by a crew of 21 hands all told. She was making about three knots with her engines working at slow, and was on course of W ½ N magnetic. In these circumstances a long blast on the whistle was heard from a steamship which proved to be the Hendonhall, apparently about ahead, and the engines of the San Lucar were at once stopped and she sounded a long blast in reply. A second long blast was heard from the Hendonhall, and was answered by the San Lucar by a long blast, and this signal was repeated by the San Lucar before the Hendonhall sounded a third blast on her whistle, and as she did so, came into sight, distant three to four ship's lengths and about ahead of the San Lucar. Thereupon the engines of the San Lucar were at once reversed full speed astern, three short blasts were sounded on her whistle, her helm was hard a-port, and three short blasts were again sounded, but the Hendonhall, though twice sounding three short blasts, continued to come on with considerable speed, and with her port bow struck the bluff of the San Lucar's port bow, doing damage. Just before the collision the Hendonhall was heard to sound a single short blast. The defendants charged the Hendonhall with excessive speed and failure to stop her engines and navigate with caution, and, further, with improperly starboarding her helm.

The court pronounced the San Lucar to blame.

Justice Bargrave Deane, in giving judgment, said: This is one of those unpleasant cases where the evidence on the two ships has to be accepted or disbelieved, and on the pleadings no collision could possibly have happened, because both ships are said to have stopped some considerable time before the collision, and neither had any way on her at the time of the collision. Therefore on the pleadings there could have been no collision. In fact a collision happened in which the combined speed, or the speed of one vessel must have been somewhere between 3 and 3½ knots, which shows that one or other of the parties is not telling a true story. I have seen the witnesses, and I have heard counsel, and the result of that to my mind is that the story told by the plaintiffs is to be accepted, and the story told by the defendants is not to be accepted. I do not want to go into details in this case. It purely depends upon the question whether one accepts the evidence on one side or the other, but there are one or two points I should like to mention so as to show upon what I base my judgment. First of all there is the place of collision. It is admitted on the part of the defendants that the collision happened 30 miles from the Royal Sovereign—30 miles through the water, that is to say, not necessarily over the ground. That shows that the defendants were going for some six hours at the rate of about five miles an hour. They say that the weather was not foggy, but you have only to look at the logbook to see that they there describe it as fog, thick fog, and dense fog, and so far as we can judge they were going at a greater rate than slow during the greater part of the time. If so, the engineer's log is untrue, because it puts the vessel as going slow. On the other hand, with regard to this vessel, the collision happened very shortly after she changed her speed from half speed to slow, and she had to alter her engines from half speed to slow and from slow to stop, whereas the Hendonhall only had to alter from slow to stop. In our opinion the story told by the Hendonhall, that she had no way at the time of the collision, is true, and the whole of the speed of 3 or 3½ knots was upon the San Lucar. If that is the case it can only be the fault of the San Lucar that there was a collision, because she has not told a true story, and she was going so fast in a fog that she could not bring herself up, and therefore came into collision. I accept the story told by the Hendonhall with regard to the weather. We all know that in the channel when you get fog you get patchy fog, and it may very well be that, as the Hendonhall says, she was in clear weather for some time. It may be said that my remarks would also apply to the other vessel. So they would but for her log, which describes "fog," "thick fog," and "dense fog" all the time. When you have got that in a vessel's log you cannot apply to her the same observations as you apply to a vessel in whose log you do not find such a description of the weather. For these reasons I accept the story of the Hendonhall and reject the story of the San Lucar, and find the latter vessel alone to blame.

THE SUEZ CANAL CO.

In their report which was presented to the annual meeting of the company at Paris last week, the directors of the Suez Canal Co. state that a year ago it was pointed out that the traffic in 1906 had been a record, and that still further progress had been shown in the first months of 1907. This progress was not only maintained, but was increased during the second half of the year. The results for 1906 were benefited by the repatriation of Russian troops, but last year's results were not influenced by any such traffic, the improvement being solely due to better trade. Notwithstanding the improved results, it is proposed to pay the same dividend as a year ago, it being thought prudent to further consolidate the financial position of the company.

Last year's receipts totaled 120,118,521 francs, an increase of 8,129,398 francs for the year. Tonnage dues on ships increased by 9,105,503 francs, but passenger receipts were less. The expenses totaled 43,642,494 francs (an increase of 1,363,024 francs), which include a transfer of 4,000,000 francs to depreciation fund, and 500,000 francs to insurance fund. After deducting the expenses there is a balance of 76,476,026 francs, an increase of 6,766,373 francs. After allowing 2,294,280 francs for the statutory re-

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serve, and adding 56,571 francs from 1906, there is a balance of 71,385,915 francs. It is proposed to carry 2,800,000 francs to special reserve (from which 3,800,000 francs were taken in 1906 to complete the dividend), to distribute 71,385,915 francs as dividend, leaving 52,402 francs to carry forward. The dividend is 126.71 francs per share, which, added to the interest of 25 francs represents a gross revenue of 151.71 francs, and 141 francs net.

The sum of 621,197,979 francs has been expended on the canal, of which 8,713,778 francs were spent last year. The depreciation fund stands at 45,105,070 francs, the insurance fund at 1,341,869 francs, the statutory reserve at 27,864,487 francs, and the extraordinary reserve at 7,000,000 francs. During the year 4,267 ships, of 14,728,434 tons net, passed through the canal, an increase for the year of 292 ships, and 1,282,930 tons, the average tonnage being 3,452 tons, against 3,383 tons in 1906. The commercial traffic of the canal, which has been increasing since 1900, reached the highest point last year, the passage of cargo and mail steamers showing an increase of 1,432,000 tons, or 11 per cent, on the total for 1906, but military navigation decreased 149,000 tons. The maritime movement on the canal was specially influenced by the increased business of India with Europe, but the transport of the products of the Dutch Indies also showed a marked increase, favored by the admission to the canal of vessels carrying oil in bulk, and Australia and Cochin China have greatly improved their exports. While the traffic on the canal in the first months of the present year has been maintained at a high level, it has been less than in the corresponding period of last year. This decline is largely due to the falling off in exports from India, where the crops in many of the provinces have suffered from bad weather. On May 19 the transit dues showed a diminution of 2,490,000 francs, and it is added that, whatever confidence the directors may have in the improvement of the general situation, and in the development of certain regions tributary to the canal, it is probable that the deficit might increase by the end of the year. Notwithstanding this the shareholders are assured that the maintenance of their dividend will not be affected.

The following are particulars of the vessels using the canal in the last two years:

	1906.		1907.	
Flag.	No.	Tons net.	No.	Tons net.
German	588	2,155,552	580	2,253,651
American	22	67,876	9	12,537
British	2,333	8,299,931	2,651	9,495,868
Austro - Hungarian	145	483,073	129	439,997
Belgium	..	.....	3	7,082
Chinese	..	.....	1	1,655
Danish	39	108,063	38	105,130
Egyptian	2	286	3	623
Spanish	28	81,063	26	75,158
French	260	856,311	239	806,786
Greek	6	5,240	21	45,494
Italian	82	181,235	86	202,112
Japanese	37	147,279	67	259,059
Dutch	202	561,322	223	632,089
Norwegian	57	80,006	47	54,299
Turkish	51	63,810	51	73,247
Portuguese	1	1,290	1	195
Russian	113	330,375	81	239,350
Siamese	1	474	1	553
Swedish	8	22,318	10	23,457
Total	3,975	13,445,504	4,267	14,728,434

THE BUYING OF COAL.

Many and varied are the methods employed today in the buying of coal. They are discussed in a lucid manner in a recent paper by E. G. Bailey, chief of the coal department, Arthur D. Little's laboratory, Boston. From this paper the following extract is taken:

"Some people buy coal simply because the price is the cheapest they have had quoted to them. Another man buys coal upon its past reputation. He thinks 'That coal has always given good results; it gave Mr. So-and-so good results, and I will keep on buying it.' Another takes the recommendation of his engineer or fireman, and no matter what the price he says, 'That coal is worth the money and I will take it.' Another man buys his coal upon the basis of the highest number of heat units per dollar. Another will make evaporative tests and buy the coal giving the highest evaporation per dollar. Of course, the latter result is what every one wants in a steam plant, but in such cases the purchaser is frequently misled, because he figures the price of his coal f. o. b., the car or vessel, and does not consider that a coal which may evaporate 8 lbs. of water to a pound of coal costs a good deal more to handle enough to supply him for a year, than if the coal evaporated 10½ lbs. of water to a pound of coal. He has to pay more for labor for having the coal brought into his boiler room; he has more ashes, and all the way through there are numerous small expenses which, if considered in the first place, might show that coal to be more expensive at the end of the year than the other coal would have been. In any case, you cannot depend entirely upon the price and quality, whether you take it from heat units or evaporation. There are certain practical things that must be considered, such as delivery and the question of spontaneous combustion. There are numerous things upon which you cannot put a definite money value, and each person must use his own judgment to a certain extent after all. He must determine the coal to buy, either from a trial, or from past use of that particular coal. There are variations in the conditions in the mines as impurities, sulphur balls; and also the preparation of the coal so that what you received from a mine last year does not prove that you will receive the same the coming year. One cannot drop the matter as soon as he has made his contract. He must follow the thing up to be sure that he is getting the value contracted for. He may determine this by inspection, and if the coal is from the same mine and of the same character, one can tell a great deal about the coal as to impurities, one of the largest factors in the question. He may make evaporative tests from time to time, and in that way determine whether the coal is giving the results previously obtained from it. He may analyze the coal, determine the percentage of ash, sulphur, and heat units. He may buy the coal on a B. T. U. basis. The use of the latter method has been much extended, and several large concerns are buying their coal in that manner. It has good points, as well as faults. The fault lies mostly in having to pay a higher price for the coal. The coal dealer is not sure his coal is going to run uniformly throughout the year, even from the same mine. He is going to have his profit and he, therefore, puts up the price from 10 to 25 cents to offset the chances of that coal being bad. If he can afford to take the risk at 25 cents a ton, why can't the buyer? There are certain cases where it is advisable to buy coal on a B. T. U. basis, but the coal man is not yet ready to do a general business on that basis. One reason why the coal man advances the price in order to offset any difference in quality is because he is not familiar with his own coal. He has probably had a few analyses from it, but he is not sure they are the average. Another reason is that by past experience the sampling of coal delivered has been done in such a way that fair average results have not been obtained. Sometimes the coal man is cheated and sometimes the buyer. A fair sample of the coal is a very difficult thing to obtain by a person who does not know all the chances for obtaining erroneous results, and that has knocked the confidence out of both the coal seller and buyer; but a proper average sample of coal can be obtained. There is a large concern which burns about 1,000 tons of coal a day, and receives a coal which runs fairly uniform. From the results of their sample it seldom varies more than ½ to 1 per cent in quality. They have learned that a few shovelfuls, or a handful here and there does not represent the average of a carload. You must take a considerable quantity from 500 to 2,000 pounds. That should be taken miscellaneously, all of it broken up and thoroughly mixed, so that a piece of slate left

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in your sample or thrown away will make practically no difference. A small sample may have a piece of slate in it that will be 5 per cent of the total. This is often found in samples taken, so you can readily see where the discrepancy comes in.

"The method of determining the quality of coal by evaporative tests is what may be considered the really practical method, but there are certain difficulties even there. The boiler efficiency varies with so many things that it is practically impossible to maintain the same boiler conditions throughout two consecutive tests. The fireman has a great deal to do with it; the load on your boiler, the draft, the cleanliness of the heating surface; all these things are very irregular. The method of determining heat units in a laboratory is a very practical one. A small amount of coal is taken, which is a representative sample if properly taken, and is burned in an atmosphere of oxygen in a steel bomb which is submerged in water. A very delicate thermometer gives the temperature of this water before the coal is burned, and by means of an electric spark the coal is ignited and entirely burned and every bit of the heat developed is absorbed by the water and the thermometer rises accordingly. From this rise in temperature the B. T. U. are determined. The result is practical, as a B. T. U. is the heat required to raise the temperature of 1 lb. of water 1 degree Fahr. It obviates all the errors which come in a practical boiler test."

ATLANTIC COAST GOSSIP

Office of the MARINE REVIEW.
Room 1005, No. 90 West St.,
New York City.

The Commonwealth, of the Fall River Line, arrived at New York on Sunday on her maiden voyage to the port, in command of Capt. H. T. Barrett, recently of the Massachusetts. The Commonwealth was launched on Oct. 9, 1907, at Cramp's yard, Philadelphia, is 456 ft. in length and has accommodations for 2,000 persons. She is 15 ft. longer than the Priscilla, the old flagship of the line, and has engines of about 8,000 H. P. She is luxuriously fitted out.

The new Holland-America liner Rotterdam arrived at her pier in Hoboken, from Rotterdam and Bologne, on Monday, after a pleasant run across the Atlantic. The Rotterdam, like many of the larger vessels in the Atlantic passenger trade, has been built more with a view to comfort than speed. Her accommodations consist of 525 first cabin, 515 second cabin, and 2,500 third cabin, and her speed is 18 knots.

The new Italian steamship Verona, which left Genoa on Friday, is bound to Philadelphia direct. She will be the first vessel of the new line to make the direct trip, the Ancona having touched at New York both ways.

The Clyde Line steamer Oneida, it is understood, will be purchased by the Baltimore & Carolina Steamship Co., to replace the steamer George Weems, destroyed by fire at sea. Th Oneida was formerly the British steamship El Callao, and was built on the Clyde in 1885.

The ship Erskine M. Phelps, which made a record run from the Hawaiian Islands to Philadelphia in 98 days, sailed on Monday for Seattle with 4,600 tons of bituminous coal.

The Russian bark Regulus, of Riga, which struck the rocks near Shippigen Village, New Brunswick, in a dense fog, is a total wreck. The captain and crew reached the shore safely. The Regulus was loaded with salt.

The steamship Venitia, formerly owned by the Hamburg-American Line, has been purchased by the Red Cross Line. She left New York this week for Nova Scotia and Newfoundland, on her maiden voyage, under the management of Bowring & Co., of New York.

The Prinz Friedrich Wilhelm, the latest addition to the fleet of the North German Lloyd, was inspected by newspaper and steamship men at her berth in Hoboken on Monday. The new vessel is not intended for regular express service, having been built to answer the purpose of a cruising steamer, and has several new features in her construction and fittings.

Dr. Thomas M. Small, surgeon of the American Line steamer St. Louis, committed suicide by shooting on Friday morning in his stateroom on the vessel, while the St. Louis was at her berth. The motive for the act is a complete mystery, Dr. Small being regarded as one of the line's most able surgeons and supposedly in the best of health. He was 35 years old, and leaves a widow.

The Hamburg-American liner Kaiserin Auguste Victoria sailed last week for Plymouth and Hamburg with 540 first cabin and 304 second cabin passengers, making a record for this season in cabin passengers.

The river steamer Aberdeen was destroyed by fire last week while lying near Cole's Island, in the St. John river. Most of the crew of nine was asleep below when the fire was discovered by those on shore, and had barely time to make their escape.

The steamship Lucy Neff, 122 days out from Bath, Me., for San Francisco, with 500 tons of carbide, put into San Pedro recently with a broken shaft. After the breakdown the vessel traveled 2,000 miles under sail.

The entire plant, including real estate, of the Neafie & Levy Ship & Engine Building Co., Philadelphia, will be sold by order of the receiver on July 28. The property comprises a group of buildings covering an area of eight acres and has a Delaware river frontage of 400 ft.

The ship Bangalore, which sailed from Norfolk on Oct. 23 for Honolulu, has not arrived as yet. The Bangalore was loaded with bituminous coal, and was last spoken on Nov. 24. She was manned by a crew of 30 men, and her cargo of coal was for the fleet in the Pacific.

TRADE NOTES.

The C. W. Hunt Co., West New Brighton, N. Y., have just issued a little pocket catalog intended merely to serve as an introduction to their general line of labor-saving machinery. Anyone interested in the diversified products of this company would do well to write for the little catalog, as it might assist him in determining his wants, which would then be more fully covered by the larger catalog. The catalog contains a number of illustrations of the applications of Hunt machinery.

The Quebec Transportation & Forwarding Co. of Quebec launched the barge Katie H. on the river St. Charles on June 16. The barge was christened by Miss Katie Hackett, the little daughter of the vice president of the company. The Katie H. is 150 ft. long, 30 ft. beam and 12 ft. deep and is intended for the carrying of pulpwood, lumber and coal. While built of oak, her beams are of steel and her construction is unusually stanch. She was designed by W. J. Hackett, manager of the company. This is said to have been the first side launching in that part of the country. The officers of the Quebec Transportation & Forwarding Co. are J. S. Thom, president; M. J. Hackett, vice president; W. J. Hackett, treasurer and manager.

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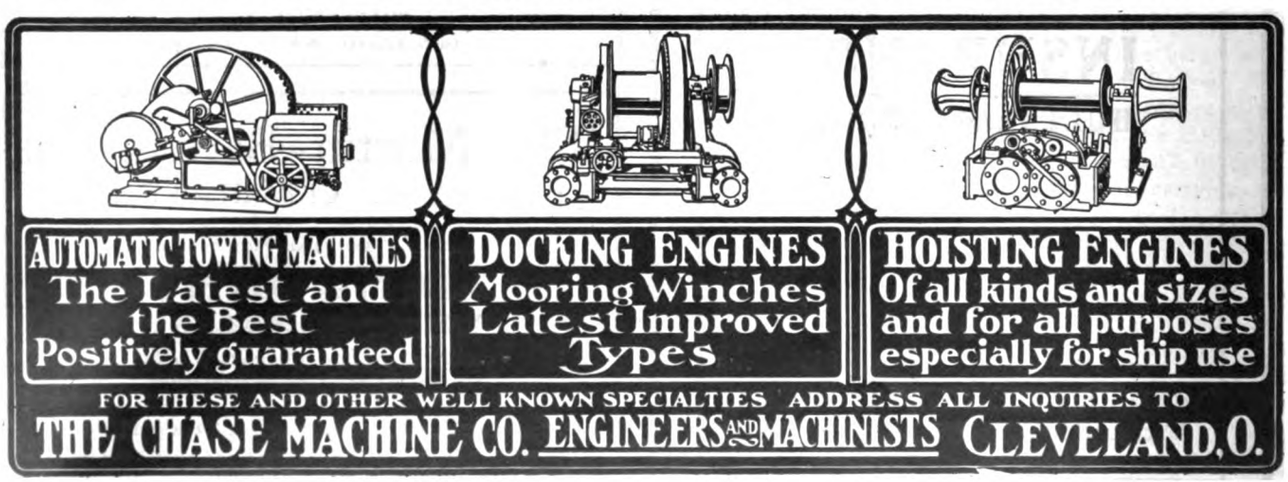
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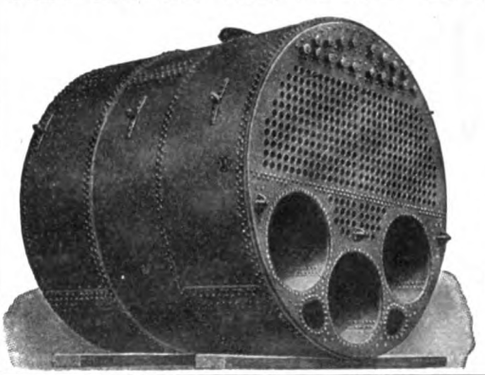

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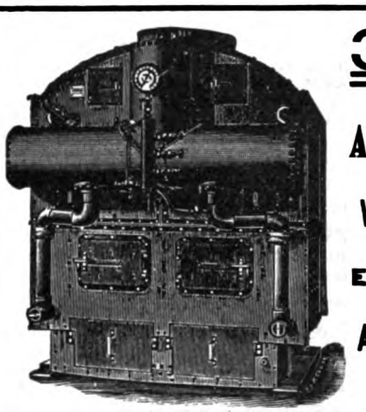

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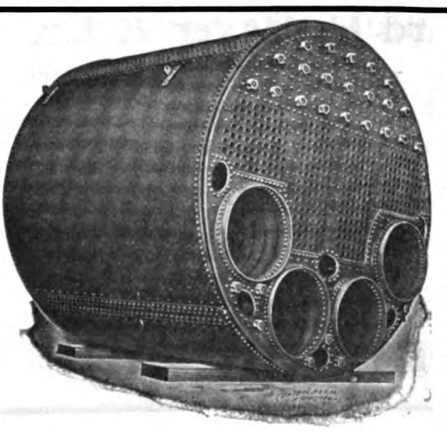

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U. S. Engineer Office, Jones Building, Detroit, Mich., June 18, 1908. Sealed proposals for dredging Hay Lake and Neebish Channels, Saint Marys River, Michigan, will be received at this office until 3 P. M., July 21, 1908. Information on application. C. McD. Townsend, Lt. Col., Engrs.

U. S. Engineer Office, Jones Building, Detroit, Mich., June 17, 1908. Sealed proposals for furnishing and delivering at St. Marys Falls Canal, Michigan, about 1,328,000 feet B. M. of hemlock timber will be received at this office until 3 P. M., July 17, 1908, and then publicly opened. Information on application. C. McD. Townsend, Lt. Col., Engrs.

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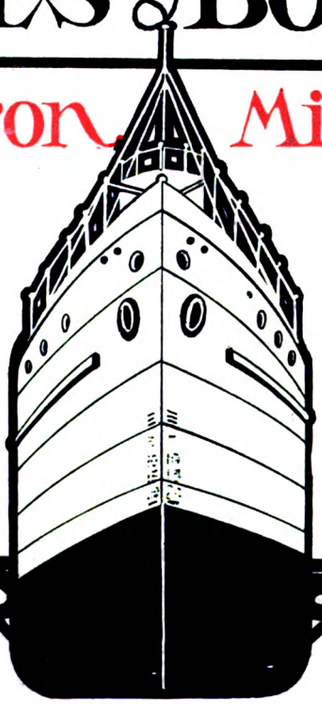

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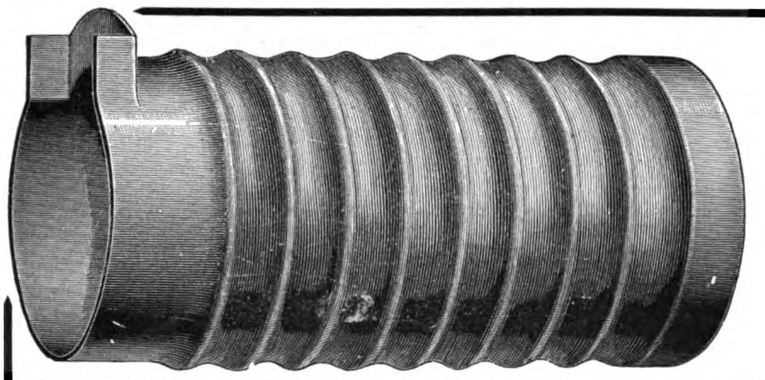

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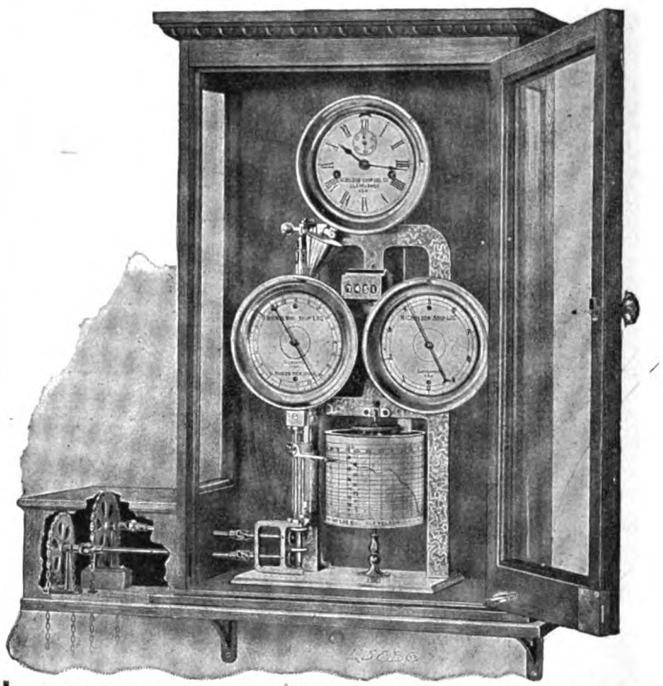

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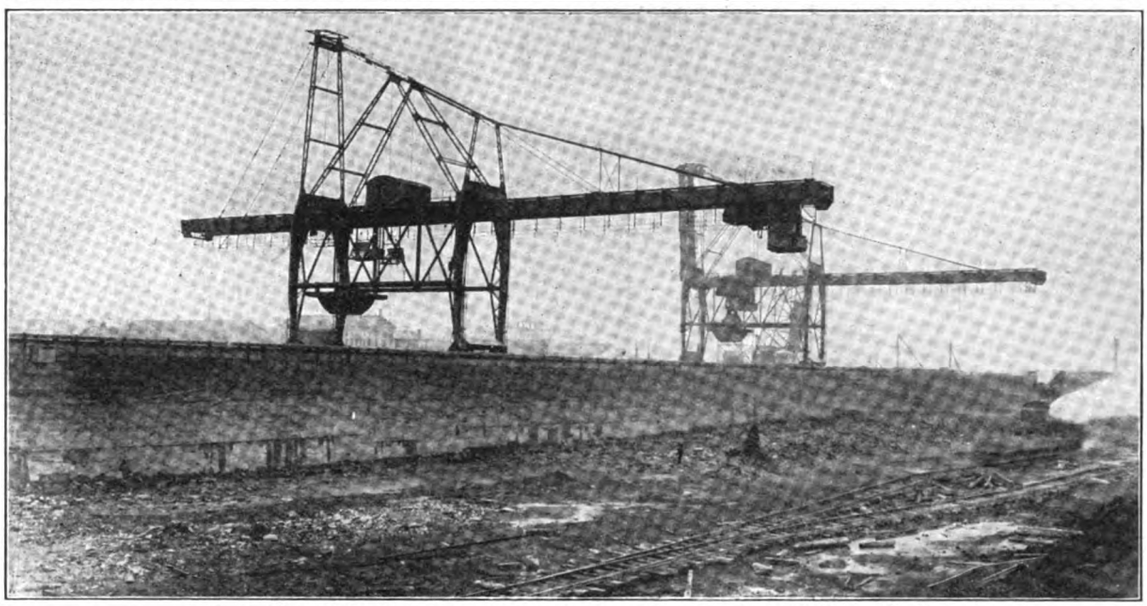

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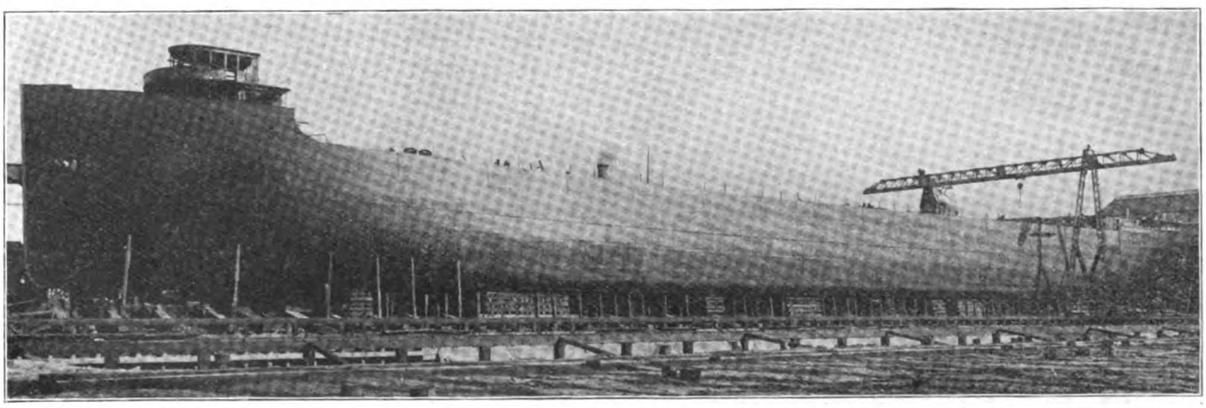

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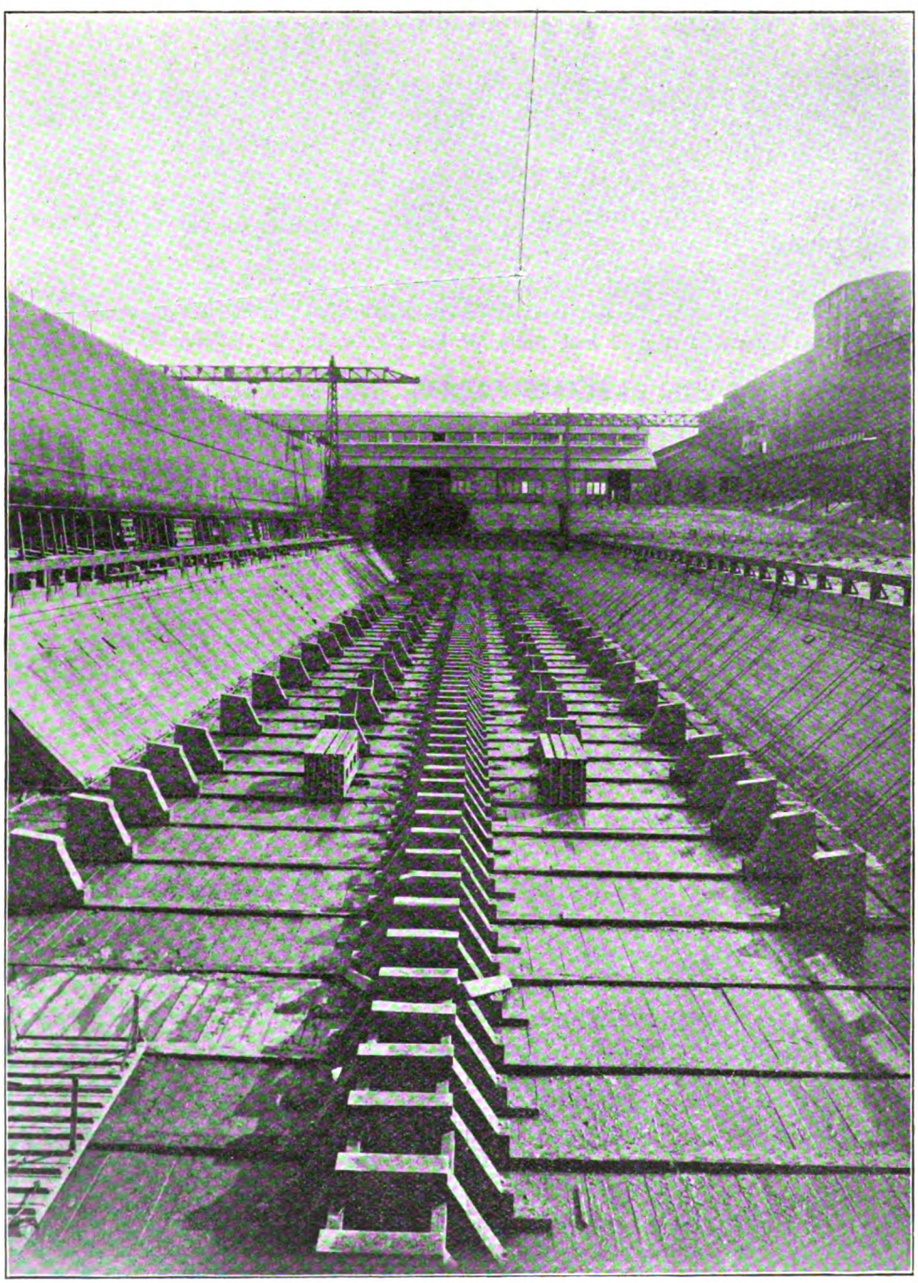

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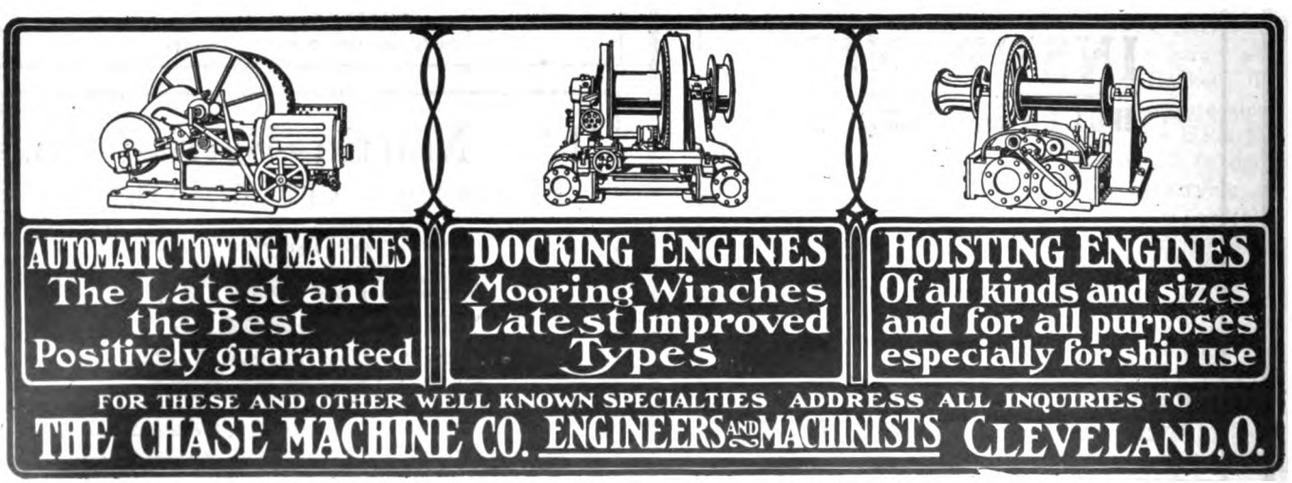
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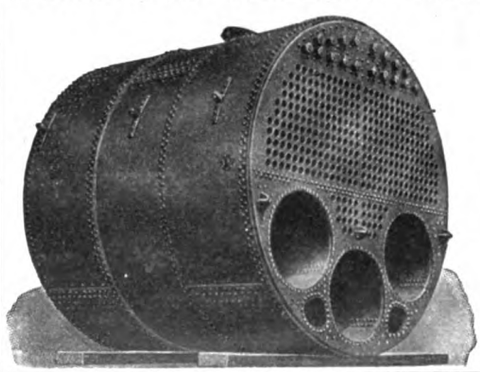

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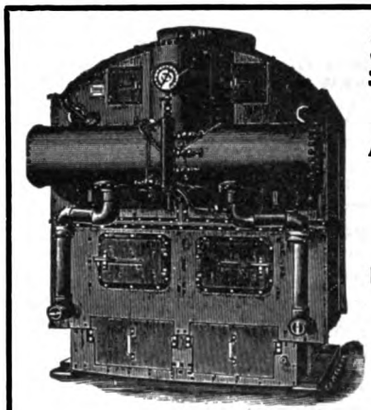

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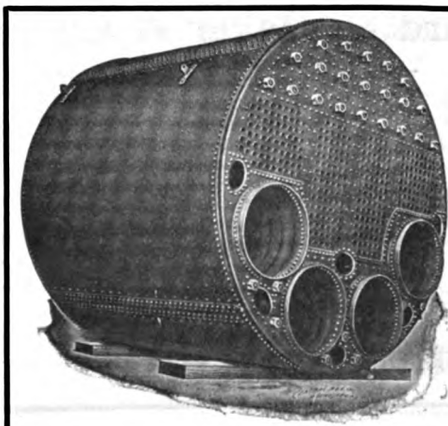

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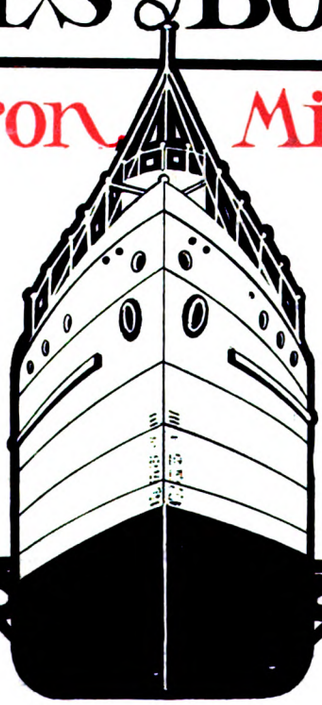

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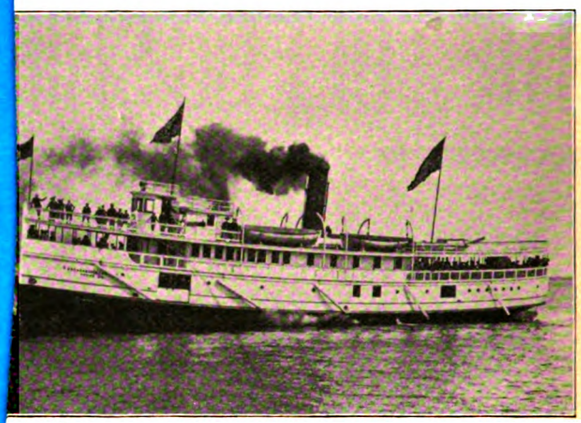

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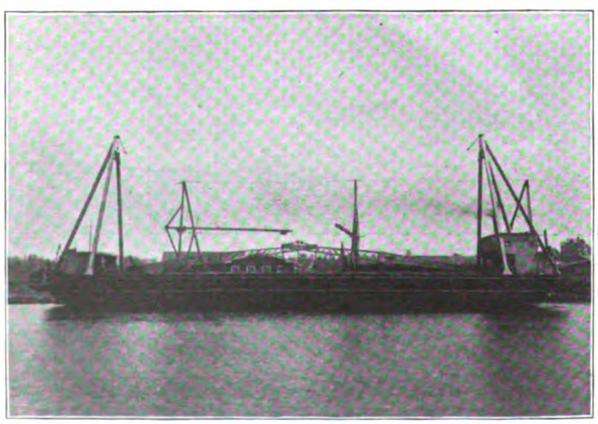

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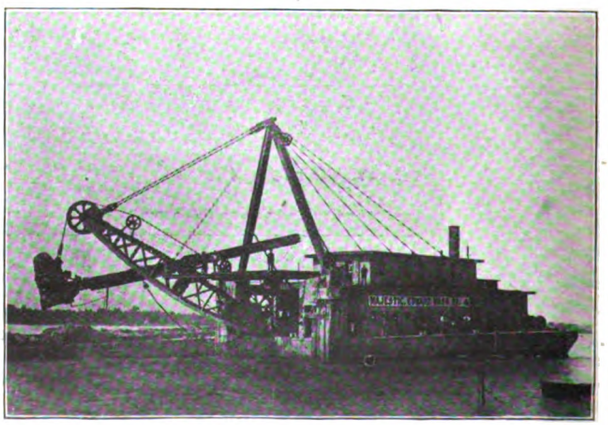

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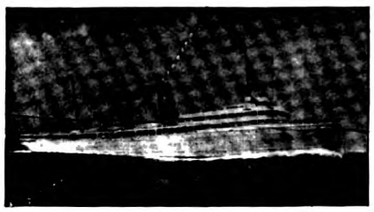

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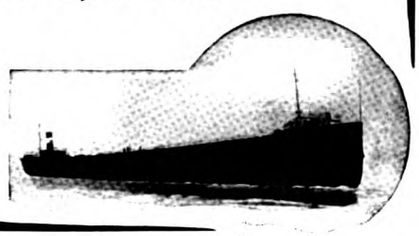

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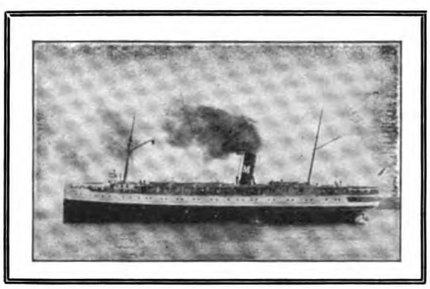

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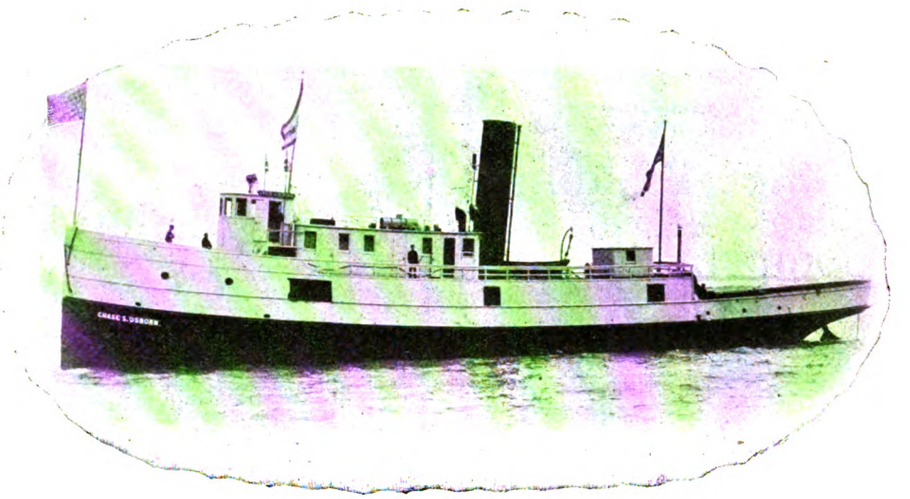
Johnston Brothers

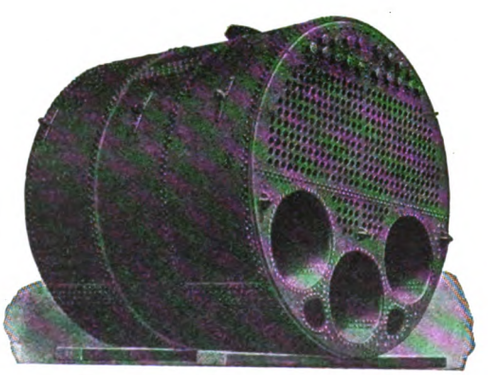
Ferrysburg, Mich.



Builders of

STEEL SHIPS

and



Modern Marine Boilers

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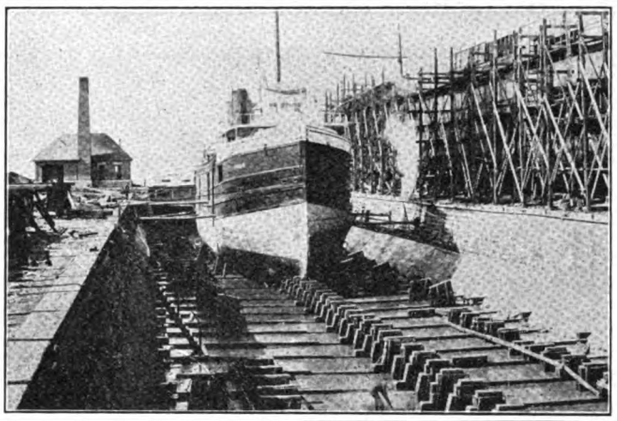


Collingwood Shipbuilding Co.

COLLINGWOOD, ONTARIO.

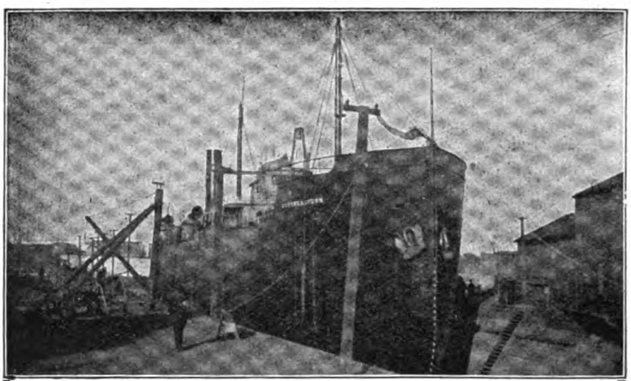
STEEL & WOOD SHIPS

Marine and Stationary Engines
Boilers and Auxiliary Machines

Dry Dock 514 ft. Keel Blocks

ALEX. McDOUGALL, PRESIDENT

J. M. SMITH, MANAGER



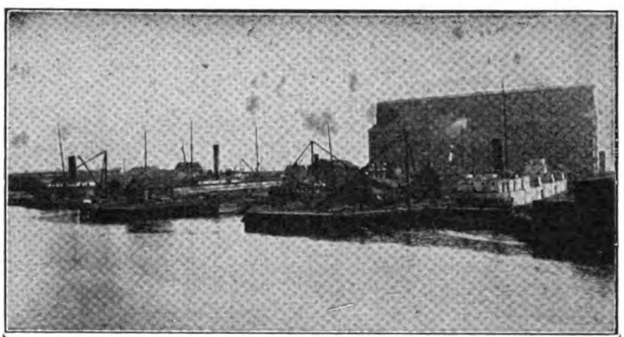
Milwaukee Dry Dock Company

MILWAUKEE WISCONSIN

SHIP REPAIRS
OF ALL KINDS

We have two ship yards offering every facility for the repair of both steel and wooden vessels. South Yard Dock is 450 ft. long on keel blocks; 460 ft. over all; 60 ft. width of gate and 16 ft. over sill. West Yard Dock is 312 ft. on keel blocks; 45 ft. width of gate and 12 ft. over sill. Rudder pit in each dock. Electric light for night work.

MAIN OFFICE AT SOUTH YARD
Foot of Washington Street
Telephone Main 3



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BUFFALO, NEW YORK

EDWARD SMITH, President EDWARD N. SMITH, Superintendent
WILLIAM KNIGHT, Ass't. Sec'y and Treas.

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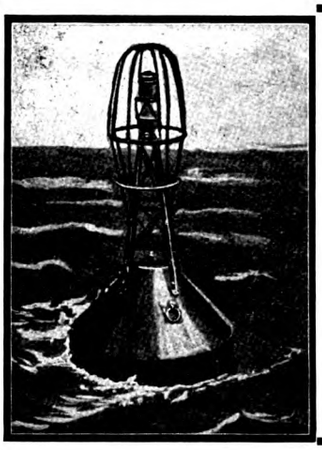
President's Residence Telephone, 209 Bryant. Ass't Secy's Telephone, 324 North.
Superintendent's Telephone, Bryant 209.



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BURN CONTINUOUSLY

FROM 80 TO 365 DAYS AND NIGHTS WITHOUT ATTENTION AND CAN BE SEEN AT A DISTANCE OF SIX MILES.

Brilliant & Steady Illumination. Economical & Reliable in Operation,

Adopted by the English, German, French, Russian and United States Light House Departments for Channel and Harbor Lighting; over 2200 gas buoys and gas beacons in service.

Controlled by the

SAFETY CAR HEATING & LIGHTING COMPANY

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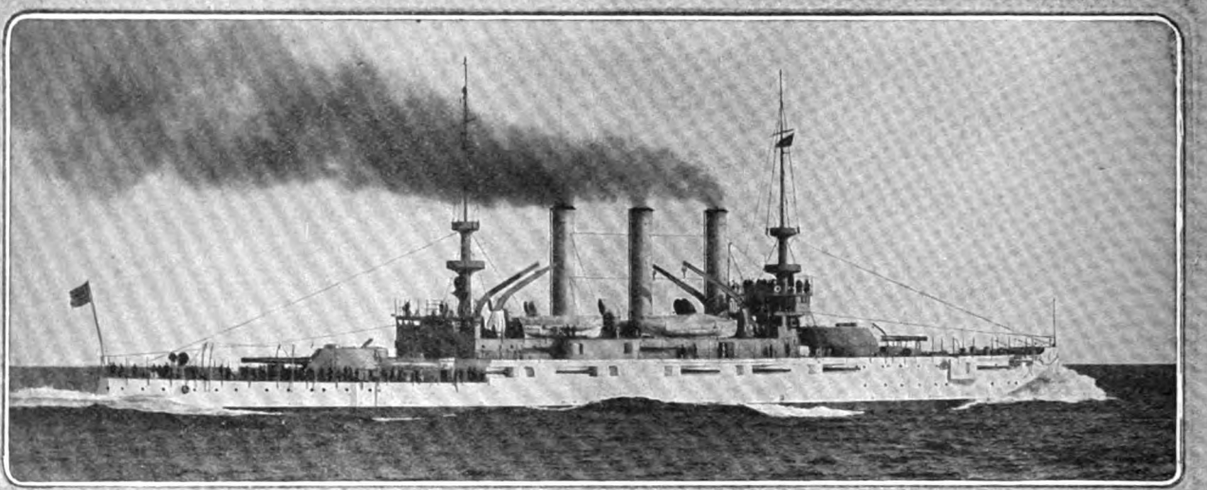
OUR SHIPYARD

WITH ITS ACCOMPANYING DRY DOCKS AND WORKS, WAS CAREFULLY DESIGNED, EQUIPPED AND COMPLETED FOR THE



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NEWPORT NEWS SHIPBUILDING & DRY DOCK CO.
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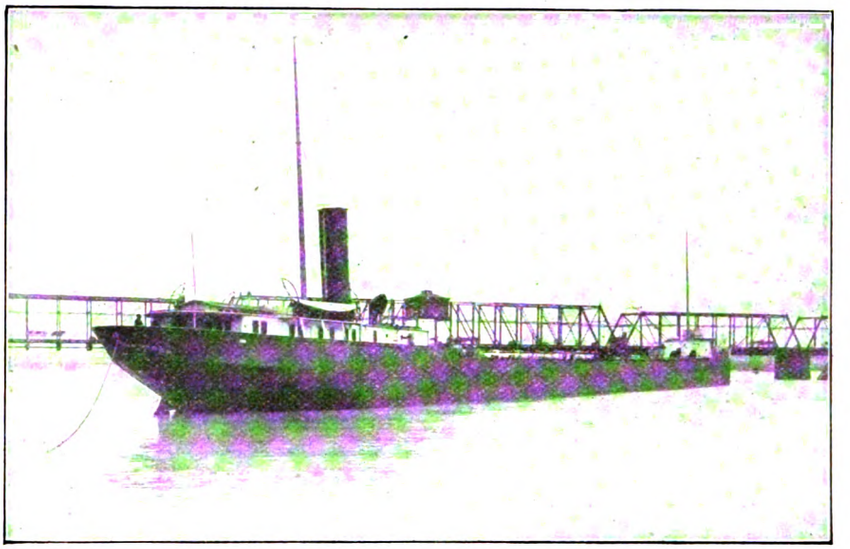

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Owned by
Toledo S. S. Co.
Toledo

Runs between Lake Erie Ports and Duluth

Jones Stokers are installed aboard these Steamships

A self contained and simple installation: Features essential in marine work.

Produce a saving in first cost of fuel: Substitution of cheap grades for higher priced grades.

A tonnage saving in fuel: Permits of an increase in cargo capacity.

Steady steam and plenty of steam for every ordinary requirement, and to quickly meet every extraordinary emergency of weather, etc. This absolute regulation due to **Automatic Control:** Means maintaining a regular schedule with consequent increase in earning power of vessel.

Lightens labors of firemen and secures a greater degree of comfort in the firehold.

Clean decks and fittings due to smoke abatement: Desirable in passenger traffic and while in port.

Send for our special bulletins on marine work

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"OSSABAW"

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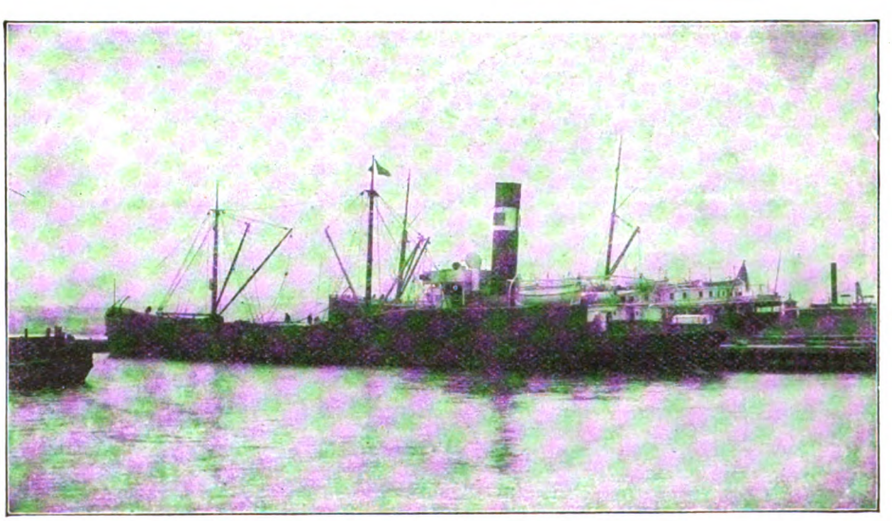
New York City

Runs between New York and Brunswick, Ga.



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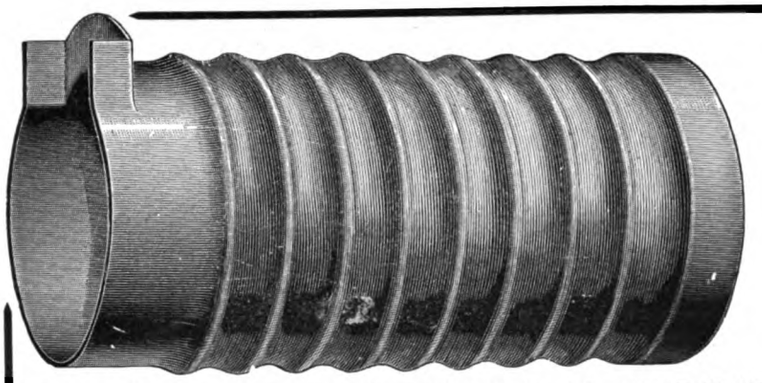

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For Land and Marine Boilers

Uniform Thickness—Easily Cleaned
UNEXCELLED FOR STRENGTH

Also Fox Corrugated Furnaces

Manufactured **THE CONTINENTAL IRON WORKS,** West and Cayler Sts., NEW YORK
Near 10th and 23d Sts. Ferries
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"CHERUB" MARK II LOGS

Walker's Patent "CHERUB" MARK II Ship Log. Fitted with ball bearings and a sliding case, to allow of the wheel work being oiled or examined without having to take the log to pieces.

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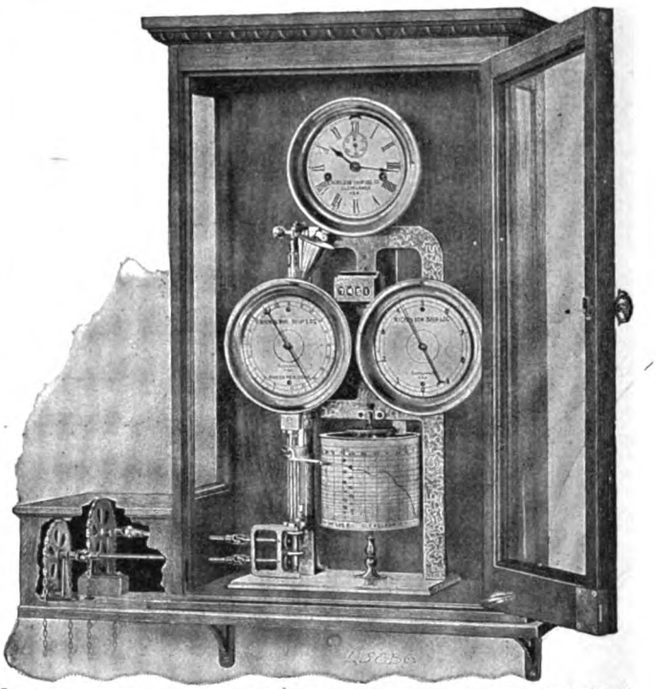
Makers to the British and Japanese Navies.

58 Oxford St., BIRMINGHAM, ENG.



THE NICHOLSON AUTOMATIC SHIP LOG

Is a radical departure from all other types. Has no trailing line outside, and is not connected with the engine, but is built in and becomes a part of the ship. It has four distinct operations working together, viz.: Time, speed in knots, or miles per hour, counter and recording chart showing every variation in speed during the trip. Can be placed in the chart room, captain's room, pilot house, or on the bridge. Send for catalogue.

NICHOLSON SHIP LOG CO.

Cleveland, Ohio, U. S. A.

When **ESTIMATES** are **WANTED** we are

pleased to offer the results from our fifty years experience;
either to recommend suitable machines or to give prices.

FROM ALL SHIP BUILDERS

who have used the "Providence" windlasses, capstans, winches, towing machines, anchors, etc., (and the list includes practically all of them in the country) we hear that "Providence" machines continue to give better satisfaction than any other machines made.
That's why we guarantee them all!
Why shouldn't they give satisfaction when we always lead with the latest and best designs?
Our Automatic Towing Machine is a money saver. We guarantee this as well as the machine.
When the time comes you'll want the information in a hurry; why not send to us now for our literature and get your name on our mailing list?

AMERICAN SHIP WINDLASS CO.

PROVIDENCE, R. I.

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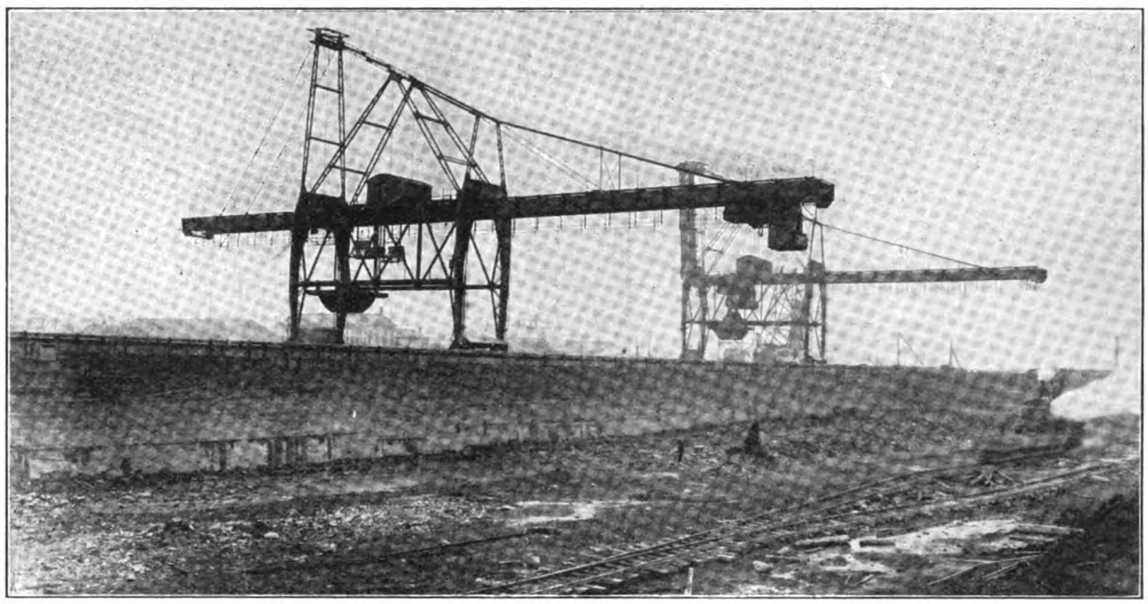

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Engineers, Designers and Manufacturers of all kinds of Hoisting Machinery.

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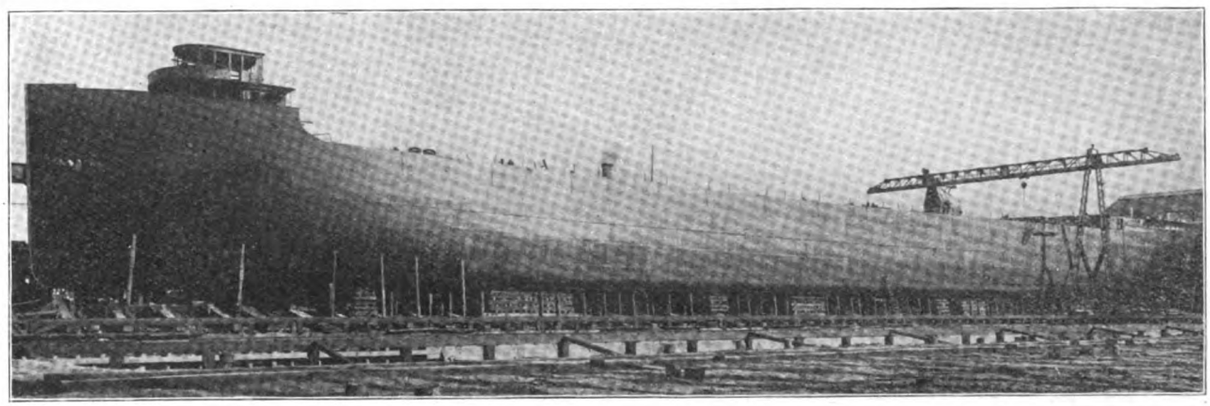
Branch Offices: NEW YORK and PITTSBURG

THE TOLEDO SHIPBUILDING COMPANY

BUILDERS AND REPAIRERS OF

SHIPS AND ENGINES



THE "JOHN DUNN, JR.," ON THE WAYS

Launched November 19th, 1907. Length 528 feet. 'Beam 58 feet. Depth 30 feet.

FRANK E. KIRBY, CONSULTING ENGINEER.

ALEXANDER McVITTIE, Pres. & Asst. Treas.
L. C. SMITH, Vice Pres. & Treas.

TOLEDO, OHIO

H. S. WILKINSON, Secretary.
CHAS. B. CALDER, General Manager.

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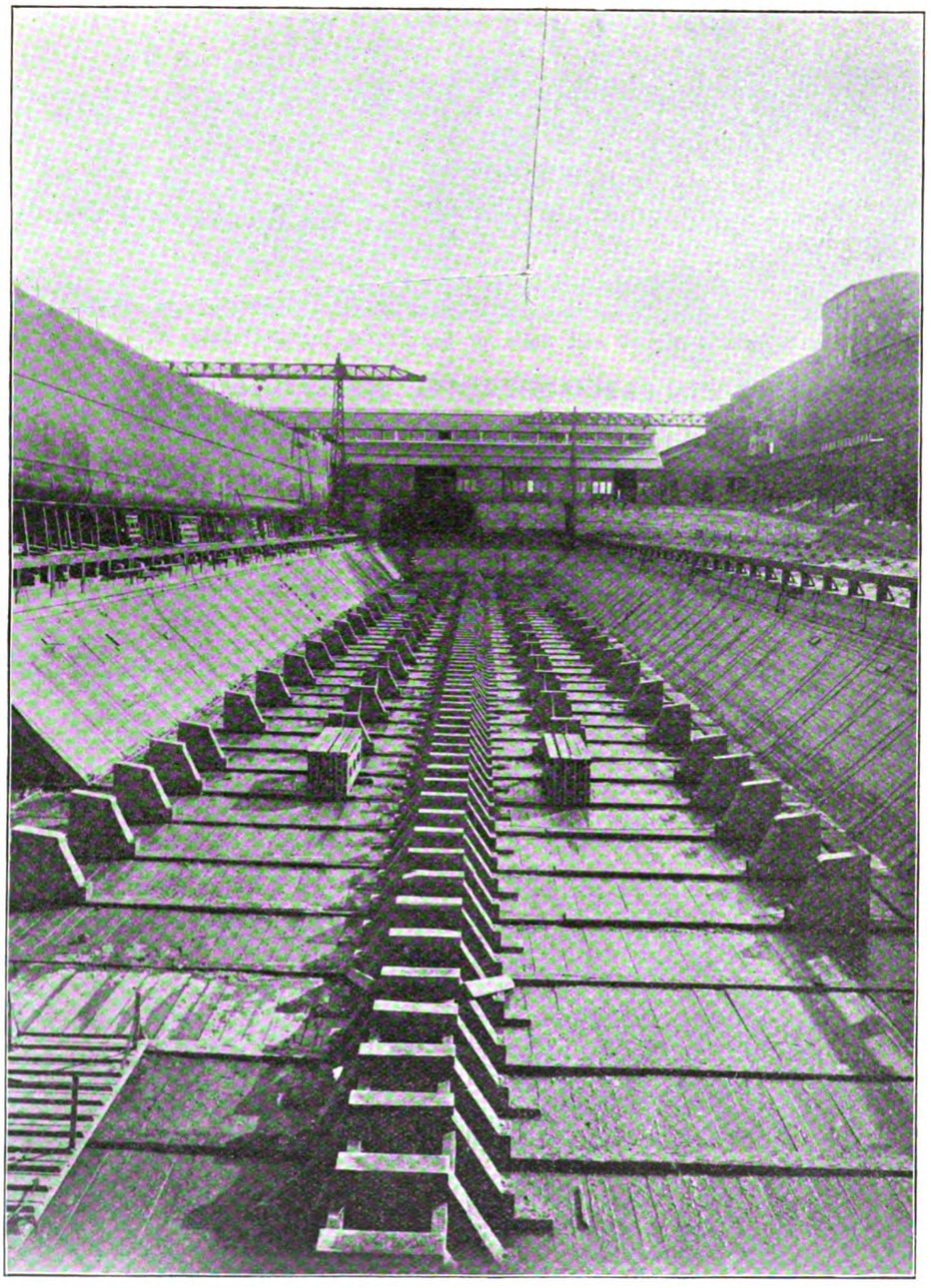
THE TOLEDO SHIPBUILDING COMPANY

TOLEDO, OHIO.



DRY DOCK NO. 2.

Showing Punch Shop, Blacksmith Shop and Gantry Cranes Over Building Berths Numbers 2 and 3

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THE M

THE TOLEDO SHIP

TOLED

DRY DOCK NO. 2.

Showing Building Berths Numbers 2 and 3, Concrete Portal and Steel Gate, 10-Ton Derrick and Gantry Crane with 32'6" Extension Over Dry Dock

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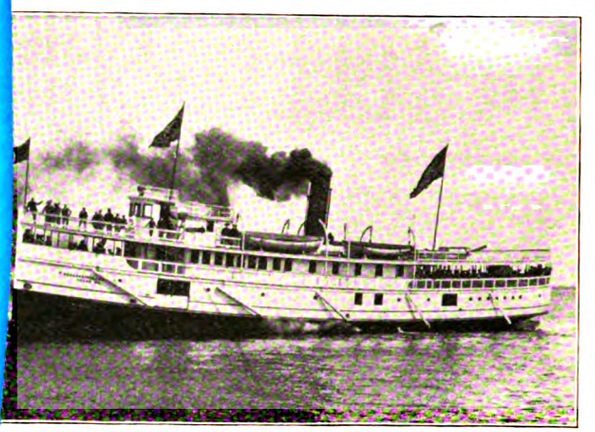

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MANITOWOC, WIS.

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—Of—

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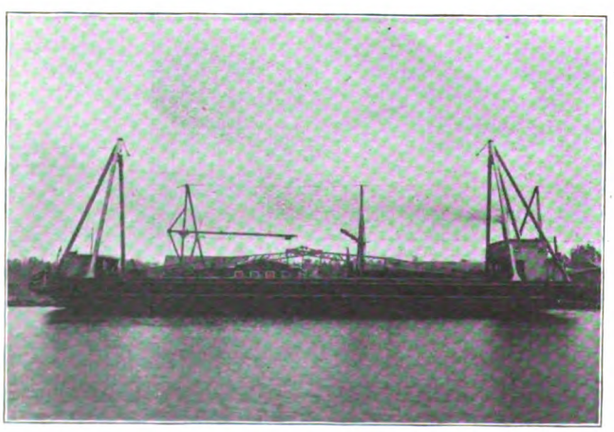
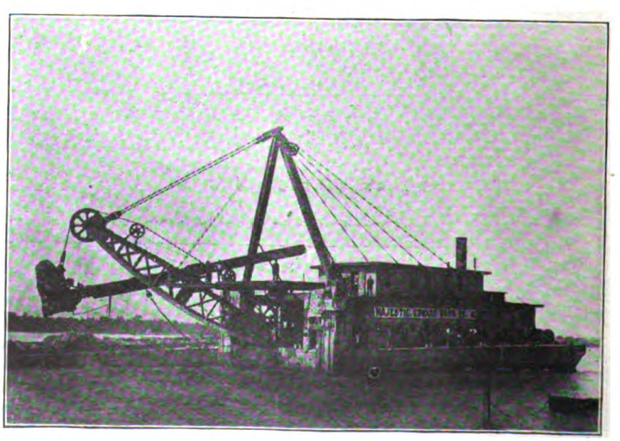


8 CU. YD. DIPPER DREDGE



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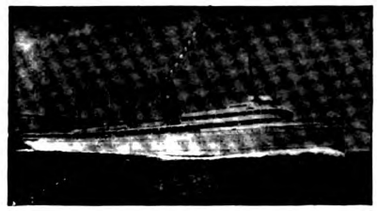

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Marine and Stationary Engines **STEEL SHIPS** Boilers and Auxiliary Machinery

Sole Agents for the Lakes for the Ellis & Eaves Induced Draft System, as applied to boilers, giving increased power and great economy.

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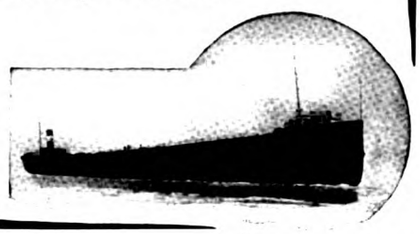

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Philip McMillan, Vice Pres. Frank Jeffrey, Gen. Supt.

Detroit Ship Building Company

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Sole Owners for the Lakes and Atlantic Coast of the HOWDEN HOT DRAFT SYSTEM as applied to Boilers, giving increased power and great economy.

Steel Ship Yard located at Wyandotte, Michigan Wooden Ship Yards and Dry Docks, Foot of Orleans Street, and Foot of Clark Ave., Detroit, Mich.

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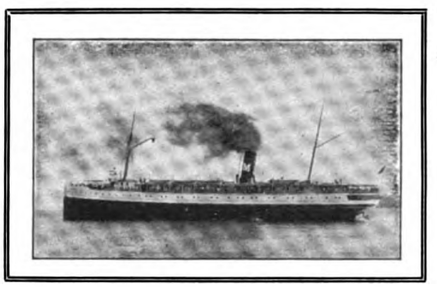
J. C. WALLACE, Vice-Pres. C. W. FREY, Ass't. Treas.
ALFRED G. SMITH, Gen'l Supt.

Chicago Ship Building Company



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Passenger or Freight

ANY SIZE

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SHIP AND ENGINE BUILDERS

Dry Docks and Repairs of all kinds

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Repairing promptly attended to, Night or Day.

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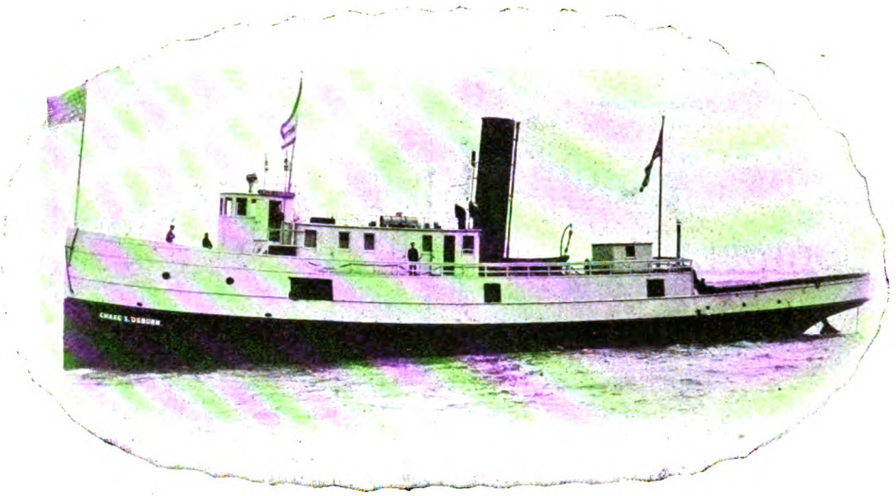
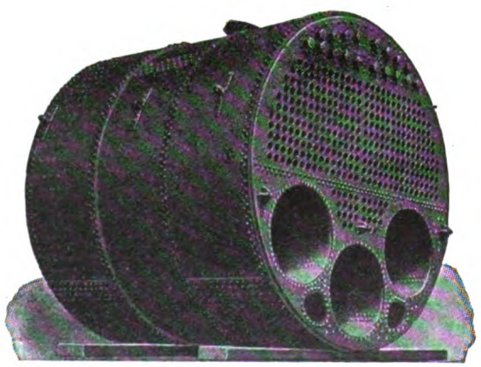


Builders of

STEEL SHIPS

and



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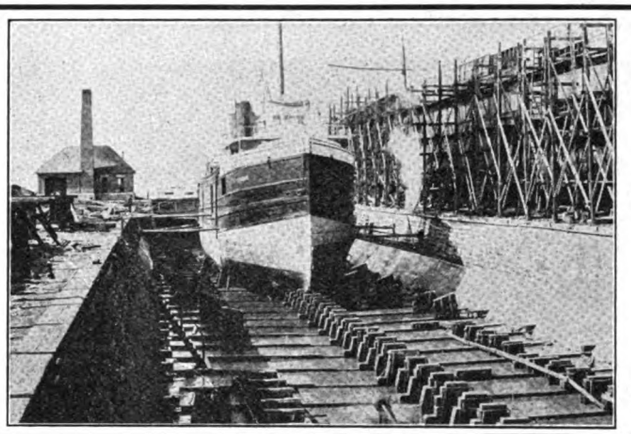

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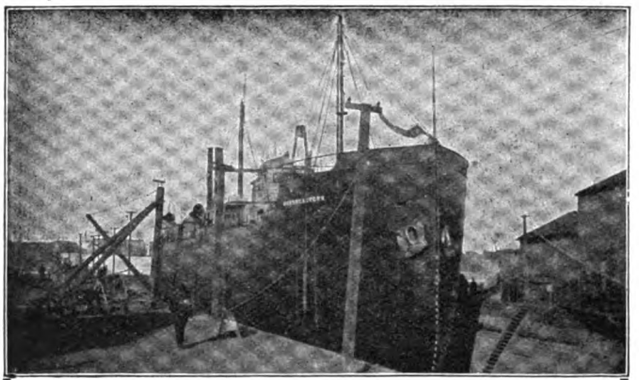
Dry Dock 514 ft. Keel Blocks

ALEX. McDOUGALL, PRESIDENT — J. M. SMITH, MANAGER



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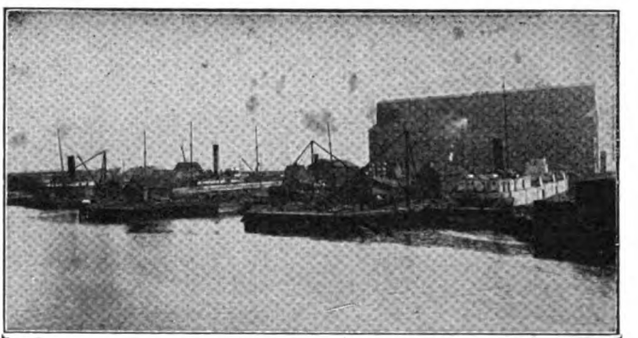
Foot of Washington Street
Telephone Main 3



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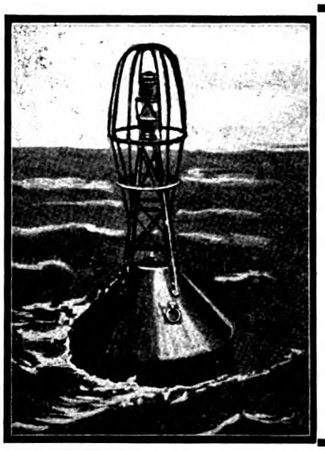

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BURN CONTINUOUSLY

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Brilliant & Steady Illumination. Economical & Reliable in Operation,

Adopted by the English, German, French, Russian and United States Light House Departments for Channel and Harbor Lighting; over 2200 gas buoys and gas beacons in service.

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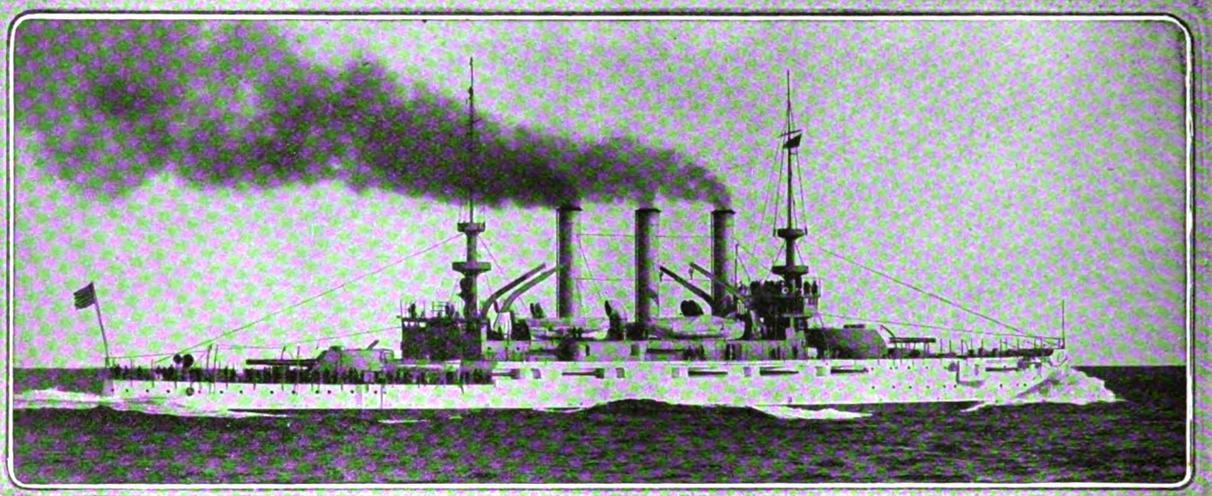
OUR SHIPYARD

WITH ITS ACCOMPANYING DRY DOCKS AND WORKS, WAS CAREFULLY DESIGNED, EQUIPPED AND COMPLETED FOR THE



CONSTRUCTION AND REPAIRING IN EVERY DETAIL OF

BATTLE SHIPS · ARMORED CRUISERS · PROTECTED CRUISERS · GUN BOATS · TORPEDO BOATS · TORPEDO BOAT DESTROYERS · SUBMARINE BOATS · OCEAN LINERS · PASSENGER STEAMERS · FREIGHT CARRIERS · ETC · ETC ·

NEWPORT NEWS SHIPBUILDING & DRY DOCK CO.
1 BROADWAY NEW YORK — NEWPORT NEWS, VA.

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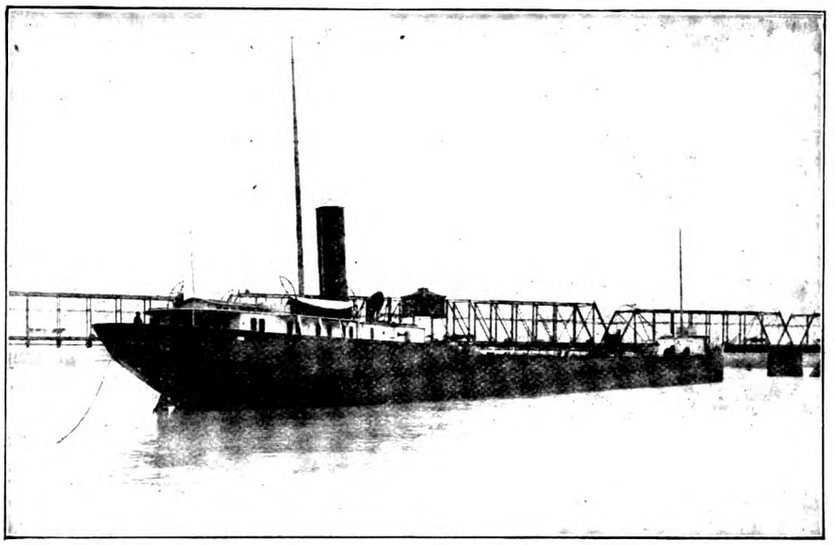


"Eugene Zimmerman"

Owned by
Toledo S. S. Co.
Toledo

Runs between Lake Erie Ports and Duluth

Jones Stokers are installed aboard these Steamships

A self contained and simple installation: Features essential in marine work.

Produce a saving in first cost of fuel: Substitution of cheap grades for higher priced grades.

A tonnage saving in fuel: Permits of an increase in cargo capacity.

Steady steam and plenty of steam for every ordinary requirement, and to quickly meet every extraordinary emergency of weather, etc. This absolute regulation due to **Automatic Control:** Means maintaining a regular schedule with consequent increase in earning power of vessel.

Lightens labors of firemen and secures a greater degree of comfort in the firehold.

Clean decks and fittings due to smoke abatement: Desirable in passenger traffic and while in port.

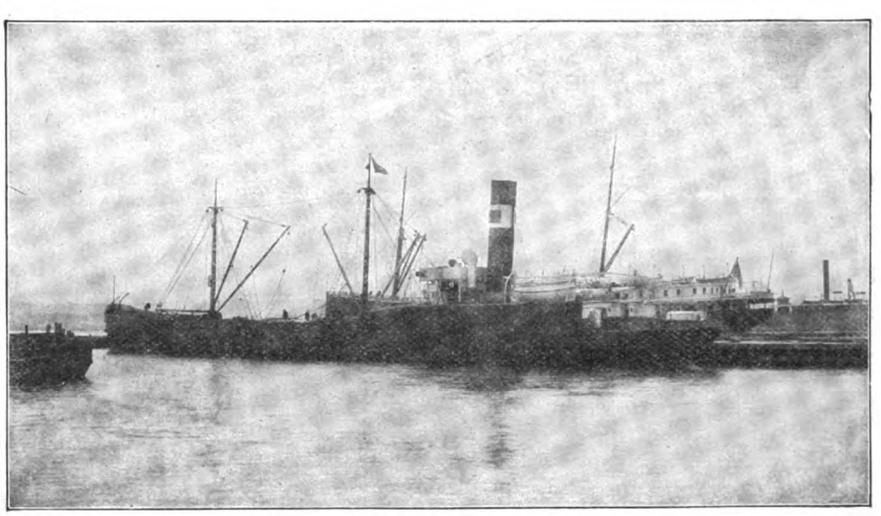
Send for our special bulletins on marine work

THE UNDER-FEED STOKER COMPANY OF AMERICA Marquette Building CHICAGO

"OSSABAW"

Owned by
Brunswick S. S. Co.
32 Broadway
New York City

Runs between New York and Brunswick, Ga.



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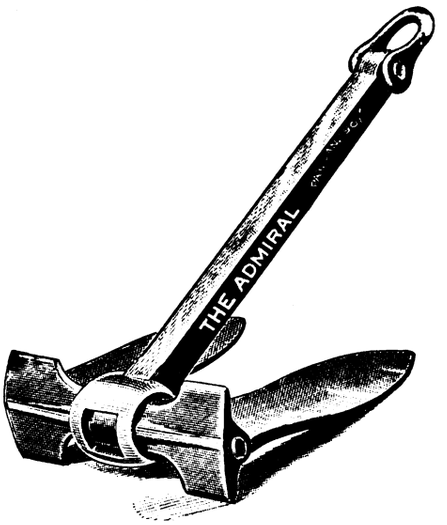
The "Admiral" Improved Stockless Anchor

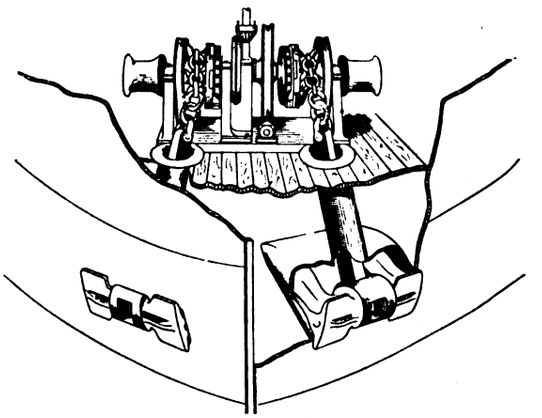
The leading Stockless Anchor of the age, used by nearly all the large boats in this country, is noted for its great strength and simplicity.



The ADMIRAL will not roll from side to side, nor break the mud while penetrating, as the flukes are parallel with the shank and make a straight pull.

The ADMIRAL Anchor is made of open hearth steel. All sizes up to 8,000 pounds, carried in stock.

Catalogue and Model mailed on request.



The "Admiral" stowed in pipe practically no obstruction

The Kidd Anchor Pocket was made especially for this anchor. Note how the flukes go farther and better into the hawse pipes—lay better, look better and are better from every point of view.

CAPT. JOSEPH KIDD,
Palladio Building, Duluth, Minn.
Agent for Great Lakes.

The Admiral Anchor Company
CHESTER, PA.

S. S. TOMPKINS, Mgr.

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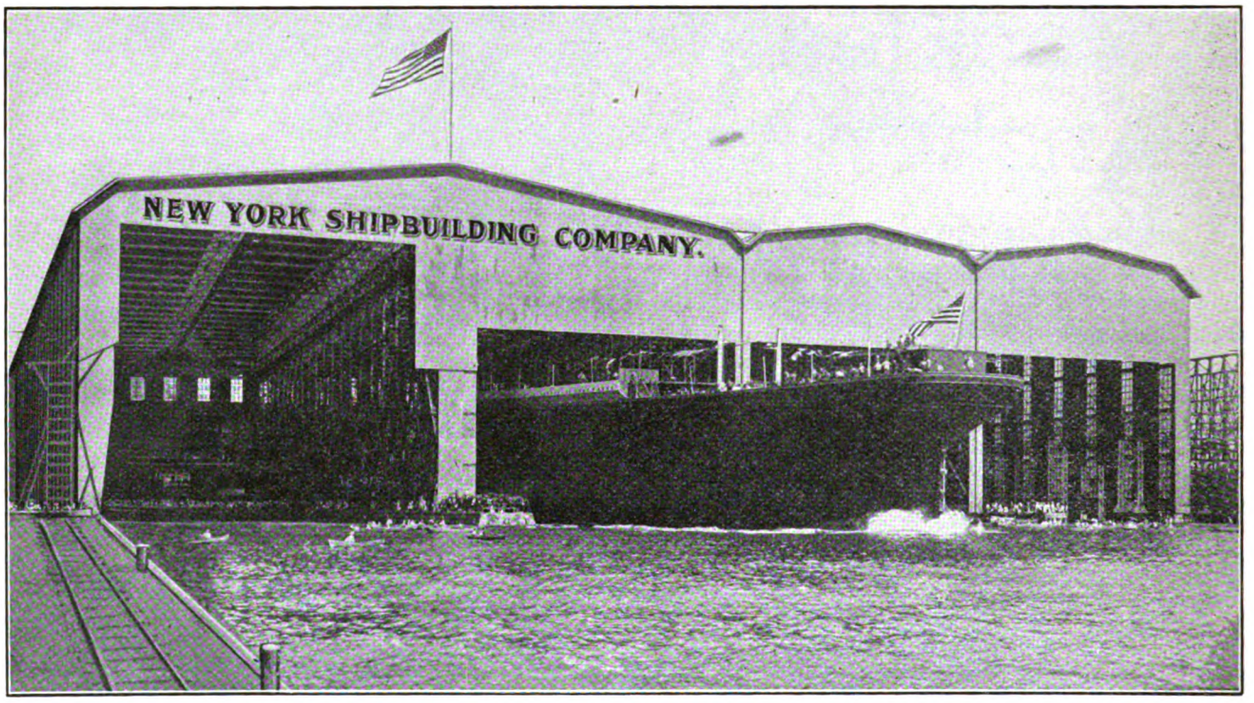
New York Shipbuilding Company

Main Office and Works, Camden, N. J. **New York Office, 12 Broadway**



Launch of "Mongolia," Pacific Mail S. S. Co., 615 feet long, 65 feet beam, 51 feet deep.

Builders of

SHIPS, ENGINES, BOILERS AND HEAVY MACHINERY

Best Facilities for Repair Work

Pneumatic and Electric Tools; ample wharfage accommodation.

One Hundred Ton Crane

Repairs done under Shelter

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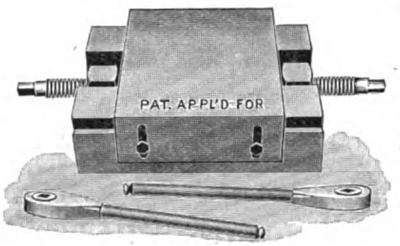
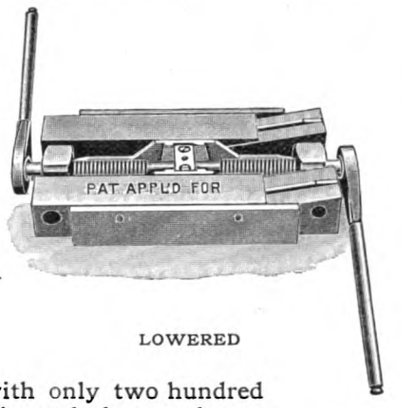
The Keymer Wedge Keel Block



RAISED

A Steel device designed to facilitate launchings and replace the wooden keel blocks now used.



LOWERED

The standard size Keymer block will raise a twenty ton load with only two hundred and ninety pounds resistance on a fifteen inch leverage and proportionately less on larger leverage. The blocks can be placed in any close quarters, yet easily operated in either direction. They will stay in position regardless of load. Can be readily removed and replaced in any position in a few moments.

The Keymer keel block has two pairs of wedges which slide upon each other by means of a right and left hand threaded screw. The average vertical movement of the cover is two inches, but that point is regulated by the size of the blocks. These blocks give a wonderful facility at launchings and will quickly replace the wooden blocks commonly used, as they are permanent articles.

We will be pleased to send at your request a superintendent with blocks to give a practical demonstration of their utility.

THE KEYMER MFG. CO.

2021 West 100th Street **CLEVELAND, OHIO**

SAWDOLET

The Ship Flooring

That protects the steel deck
That is not slippery
That is placed directly on the steel deck
That is right in price
That is clean and sanitary
That is light, strong and flexible
That can be laid in any color, anywhere

Boats Floored in the Year 1906

"Douglass Houghton," Pittsburg Steamship Co., Cleveland, Ohio
"William Edenborn," Pittsburg Steamship Co., Cleveland, Ohio
"D. R. Hanna," Hutchinson & Co., Cleveland, Ohio

Boats Floored in the Year 1907

"Jas. B. Morrow," Joseph Sellwood
"M. Andrews," Henry Steinbrenner
"L. S. DeGraff," Weston Transit Co.
"Wm. Mills," Weston Transit Co.
"Odonah," Lackawanna Steamship Co., Cleveland, Ohio
"Crete," Lackawanna Steamship Co., Cleveland, Ohio
"Cyprus," Lackawanna Steamship Co., Cleveland, Ohio
"Adriatic," Lackawanna Steamship Co., Cleveland, Ohio
"Verona," Lackawanna Steamship Co., Cleveland, Ohio
"J. C. Morse," Lackawanna Steamship Co., Cleveland, Ohio
"Elba," Lackawanna Steamship Co., Cleveland, Ohio
"J. J. Sullivan," Hutchinson & Co., Cleveland, Ohio
"Queen City," Pittsburg Steamship Co., Cleveland, Ohio

THE C. CLEMENTE COMPANY

Park Bldg., Cleveland, O.

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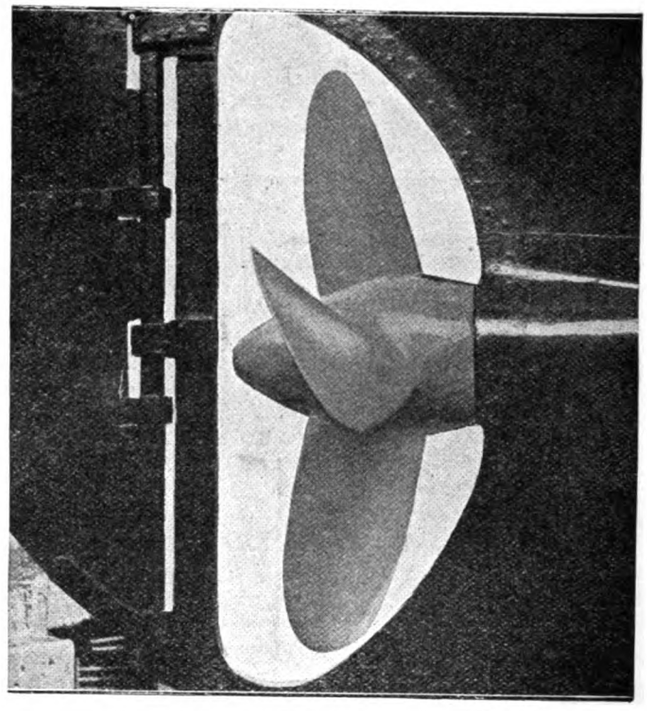
THE WALTERS

With Patent Ropeguard Extending to Sternpost

We guarantee under cash penalties an extra half knot in fine weather on the same I. H. P. on any steamer against any other propeller in the same metal, and a knot in head seas.

There is nothing fantastic about the propeller. By means of a differential pitch superimposed on a large hub—masked fore and aft by cones—we practically eliminate the useless middle portions, and the whole power of the engines is thrown onto our broad blade-tips.

S. T. "ESSEX" & "SIDMOUTH"



SELLICK, MORLEY & PRICE, Steamship Offices, MILFORD HAVEN, *5th of December*, 1906.

This is to certify that in July last we replaced the propeller on our new S. T. "Essex" with a Walters Patent Propeller, careful speed trials made by ourselves and staff showing 9.9 knots with 98 revs. with a heavy beam swell, as against 9.4 knots on 116 revs. with the first propeller.

Encouraged by this, yesterday we fitted her sister ship, the "Sidmouth," also new; the results in this case under similar supervision being 10.2 knots on 114 revs., as against 9.4 knots on 118 revs. with her first propeller.

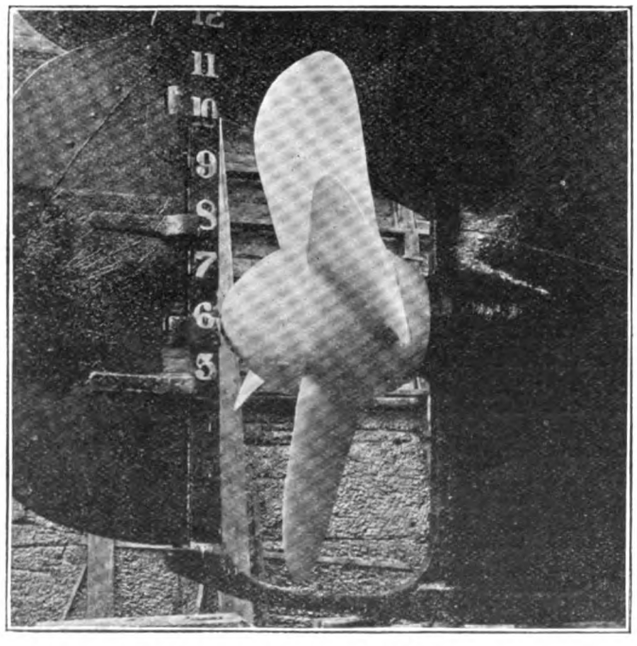
The two boats are somewhat fuller in the body than usual, and both increases of speed were obtained on slightly deeper drafts.

All deck and engine room sea reports agree that on the "Essex" this propeller is, relatively, still faster in head seas, and that it tows a trawl steadier with reduced revs. in worse weather than was previously possible.

Our personal appreciation of the Walters Propeller is perhaps best indicated by the fact that we are at present fitting our new boat (building) with it, and discussing the matter of fitting the rest of our existing fleet.

SELLICK, MORLEY & PRICE.

S. S. "CORNUBIA"



THE LIVERPOOL, BRISTOL AND HAYLE STEAMSHIP CO., LTD.
(Hosken, Trevithick, Polkinhorn & Co., Ltd.)

HAYLE, *16th May*, 1907.

S. S. "Cornubia."

We have pleasure in certifying that we recently fitted the above steamer with a Walters Propeller; that Company guaranteeing us an extra half knot on the same or less consumption, and a knot in head seas, on "No Cure, No Pay" terms.

In order to obtain exact comparative data, we first put the steamer over the measured mile; the mean of six runs showing 9.2 knots on 76 revolutions.

After fitting the Walters Propeller, we again tried her over the measured mile; the mean of six runs showing 9.8 knots on 74 revolutions, the vessel being an inch deeper in the water; an increase of six-tenths of a knot.

This result is corroborated by loaded sea passages; the increased speed in head seas being particularly marked, being reported by careful comparison with other steamers as one and a half knots per hour.

The steamer now takes from 2½ to 3 hours less on her 30-hour passages from Liverpool to Hayle or Bristol, and vice versa, and is therefore able to catch tides which she was quite unable to do before. She also comes astern and answers the helm much more readily than she previously did.

We are thoroughly satisfied with the propeller, which has amply fulfilled all the Walters Company claimed for it.

HOSKEN, TREVITHICK, POLKINHORN & CO., LTD.

PARTICULARS REQUIRED FOR DESIGNING: A figured sketch of present or proposed propeller **in position on the shaft in the aperture,** *I.H.P., revs. per min., present average speed or proposed speed, and if possible, the loaded co-efficient.*

Important to Shipbuilders & Engine makers: We are open to treat for the sale of our patent rights for America.

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PROPELLER

No Rope Can Jam This Propeller

The high tariff prohibits our exporting to the United States but we will mail you complete working drawings and fitting instructions and you can then have the propeller cast and fitted by your own people. Royalty for designing: Up to 10 ft. diameter; 8 dollars per foot diameter; 10′ to 15′ diameter; 12 dollars per foot; over 15 ft. 15 dollars per foot; payable HALF when ordering, and balance in six months when you are satisfied.

The Royal Mail Steamers "GANDO" and "SALAGA" (6,000 tons deadweight, 2,600 I. H. P. loaded co-efficient .74), new facsimile steamers; the former fitted with the Walters' Propeller; the latter with a uniform elliptical—both in Manganese Bronze, have now completed their sea-going tests, extending over two voyages.

The "GANDO" is over three-quarters of a knot (.8) faster than her sister ship in fine weather on a slightly less consumption, and about a knot and a half in head seas.

The owners have consequently since fitted their S. S. "MELVILLE," 7,200 deadweight, with a Walters' Propeller, and purpose fitting others.

R. W. GARDNER & Co., LEITH,
Steamship Owners. *4th September, 1906.*

S. S. "Claremont."
Deadweight, 3,150 tons. Loaded Coefficient, 798.

This is to certify that some months ago we fitted this steamer with a Walters Propeller, being guaranteed by the Walters Propeller Company an extra half-knot on the same I. H. P. in fine weather and a knot in head seas against any propeller that might be in position, and have since carefully tested same.

A comparison of the logs of two voyages before and two after fitting, from Archangel to Holland, and *vice versa*, made in collaboration with our Consulting Engineer, and with the guarantee in view, shows the best day's work (loaded ship) with the original propeller to be 216 knots with "Strong fair wind and following sea," and with the Walters Propeller 232 knots "Calm and clear," an increase of two-thirds of a knot.

In head winds and seas the difference is very great; two consecutive entries with the Walters Propeller reading "Fresh wind and head sea," 225 knots, and "Strong head wind and sea, vessel plunging," 221 knots. So far as we can judge, the distance under similar circumstances with the original propeller would have been about 190 knots.

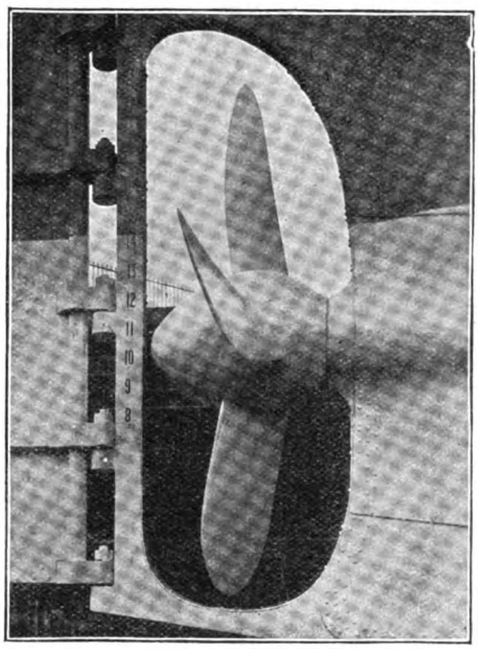
The Captain and Engineer report that there is no racing or appreciable vibration, either light or loaded.

Revs.—Original propeller, 66; Walters Propeller, 67.

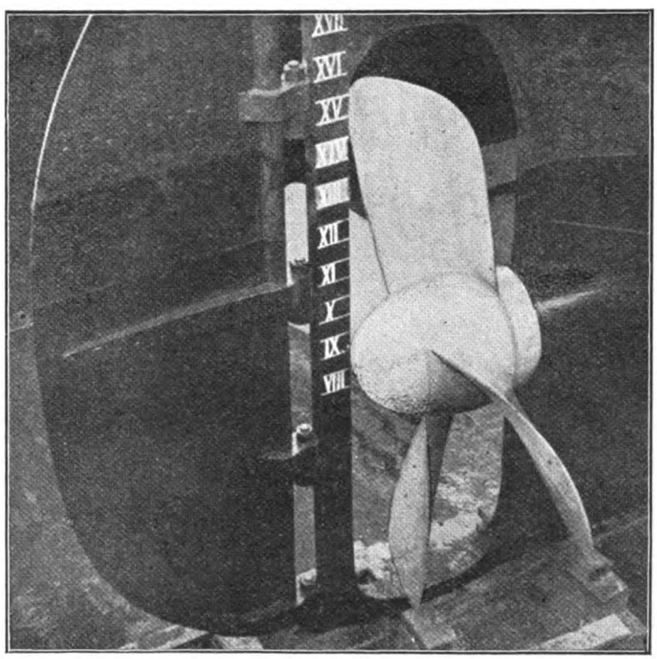
We are perfectly satisfied that the Propeller has complied with the guarantee given, and have pleasure in issuing this certificate.

R. W. GARDNER & CO.

R. M. S. "GANDO"



S. S. "CLAREMONT"



An illustrative and descriptive booklet containing many more certificated results similar to above relative to all classes of vessels, from motor launches to mail steamers, will be mailed free upon application to:

WALTERS PROPELLER CO., LTD.
Propeller Experts and Designers
LIVERPOOL, ENG.

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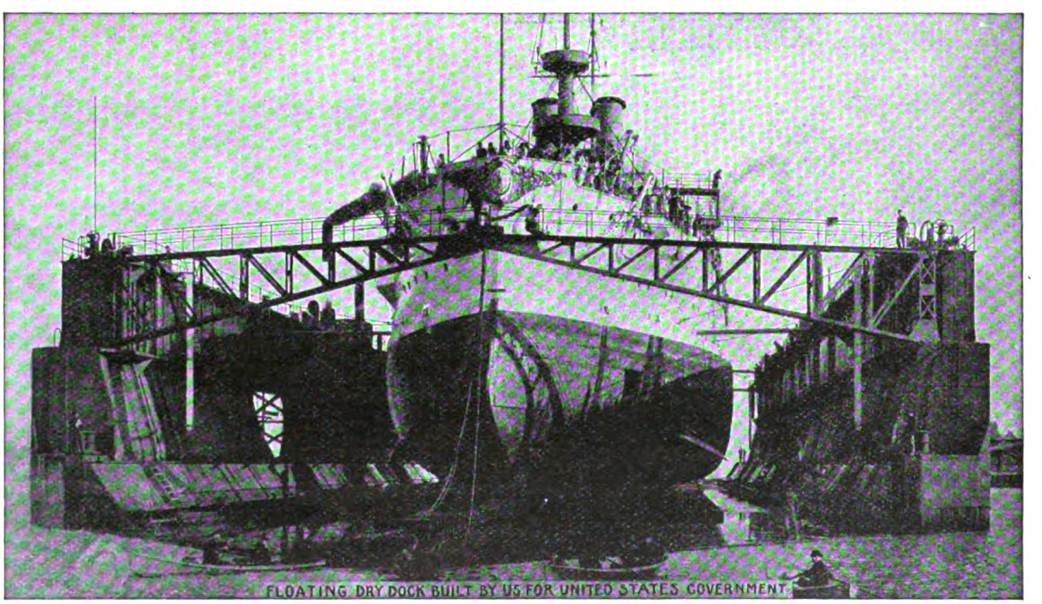
MARYLAND STEEL COMPANY

BUILDERS OF STEEL STEAMSHIPS, TOW BOATS, SAILING VESSELS, BARGES AND STEAM CRAFT OF EVERY DESCRIPTION

STEEL FLOATING DRY DOCKS CAPABLE OF DOCKING THE LARGEST VESSELS



FLOATING DRY DOCK BUILT BY US FOR UNITED STATES GOVERNMENT

SPARROW'S POINT, MARYLAND.

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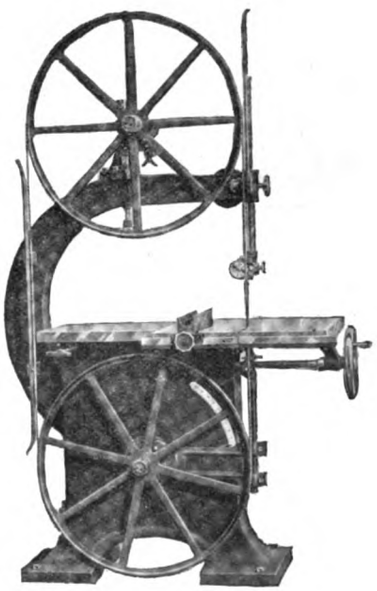
The Crescent Angle Band Saw is an Ideal Machine

for use around a ship yard, dry dock or marine railway

CUTS ANY ANGLE UP TO 45 DEGREES

The machine is substantial in construction and of modern design.



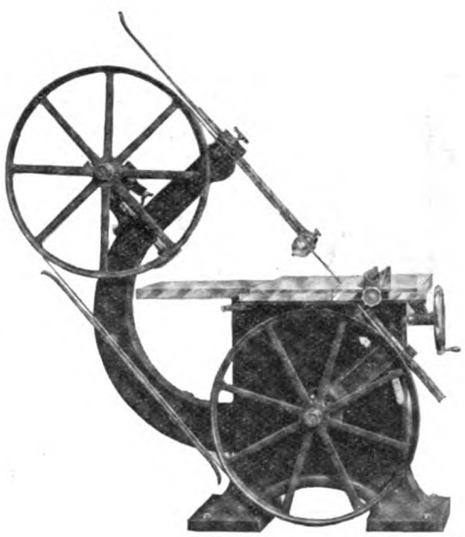
No complicated mechanisms.

No throat blocks to change.

Guides always keep same relative position to saw blade.

Tension on blade always uniform regardless of angle.

To change angle of saw---turn hand wheel at side of table---that's all.



This space cost too much to tell all about it here, but we shall be glad to mail you catalog giving complete information and describing a fine line of Band Saws, Jointers, Saw Tables, Swing Saws, Shapers, Disk Grinders and Planers.

The Crescent Machine Co.

27 Cherry St.,

LEETONIA, OHIO, U. S. A.

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MULHOLLAND'S HATCH FASTENER

(PATENTED)

This fastener secures with one grip and in one operation the hatch cover, tarpaulin and batten.

It has held hatch coamings and hatch covers together in storms that have torn the deck itself off the vessel.

It can be applied to steel hatches as well as to wooden ones. Testimonials received from vessel masters prove that it relieves them from the fear of a loosened hatch.

JAMES DAVIDSON
Bay City, Mich.

Dec. 11, 1907

Capt. M. Mulholland,
Cleveland, O.

Dear Sir:—

Answering your favor of December 10th, relative to the experience we have had with your Patent Hatch Fasteners, will state that we have equipped a great many steamers, barges and schooners with your Patent Hatch Fasteners, and we have never had any complaint. They seem to hold the hatch covers and tarpaulins on firmly, and have given us the best of satisfaction in every way, shape and manner, and we will be very glad to give the result of our experience to any person that you may refer to us.

Yours very truly,
JAMES DAVIDSON.

G. A. TOMLINSON
Lake Transportation
Duluth, Minn.

Dec. 12, 1907

Dear Sir:—

The Mulholland Patent Hatch Fastener is installed on several vessels of my fleet. They have been in use for four years on two of the ships. I have experimented with four other hatch fasteners and have no hesitation in saying that the Mulholland design is superior to any fastener with which I have had experience. The three ships now building for the companies operated by me will be equipped with Mulholland fasteners.

Very truly,
G. A. TOMLINSON.

To
Capt. M. Mulholland,
% M. A. Bradley,
Citizens' Bldg.,
Cleveland, Ohio

M. MULHOLLAND

1203 Citizens Building

CLEVELAND, O.

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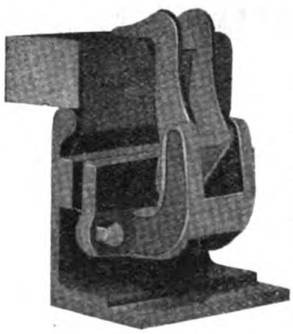
The Simplex Hatch Fastener



These cuts illustrate the Simplex Hatch Fastener as applied to the hatches of lake vessels. The left hand cut shows the fastener in position on the hatch, and the right hand cut the fastener when open and housed away inside of the bracket.

These fasteners are made in different patterns for use with any style of hatch coamings and for wood or steel covers.

These fasteners are now in use on over eighty vessels on the lakes, about 40,000 in all having been fitted.

SIMPLEX HATCH FASTENER COMPANY,

JAMES NACEY, Agent.

209 Western Reserve Building. **CLEVELAND, OHIO**

The Sturrock Patent Furnace Bridge Wall

ALEXANDER HYND, Agent for Great Lakes

208-209 Western Reserve Building, Cleveland, Ohio

SPECIAL ADVANTAGES

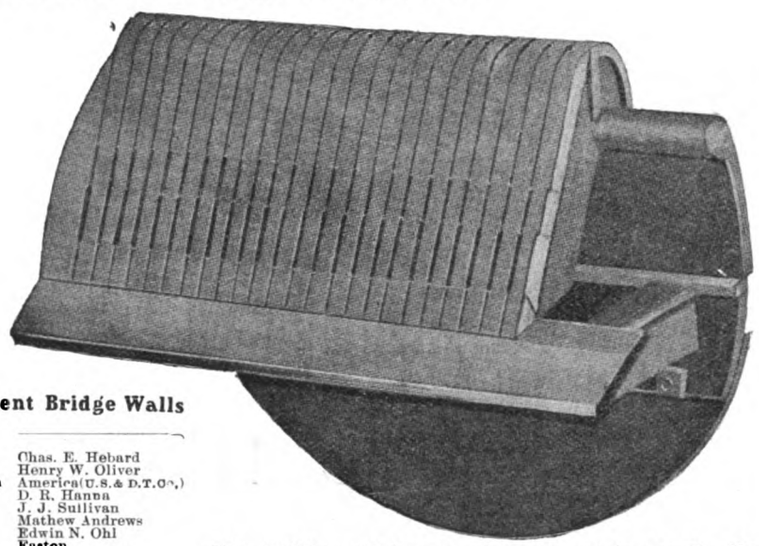
Can be removed without destroying any part of the bridge, and all replaced without requiring any renewals.

No dead fire at the bridge wall, as no clinker ever collects on it.

Will not burn, warp or twist.

A permanent bridge wall entailing no expense for renewals.

Will save its cost many times over.



Some of the Steamers using Sturrock Patent Bridge Walls

BRITISH		GREAT LAKES	
Etruria			
Elsiston	Winnebago	B. F. Jones	Chas. E. Hebard
Clematis	Chas. Beatty	James Laughlin	Henry W. Oliver
Ellaston	Wm. E. Reis	Capt. Thos. Wilson	America(U.S.& D.T.Co.)
Unity	John G. Howard	Joshua Rhodes	D. R. Hanna
Cleethorpes	M. A. Hanna	W. G. Pollock	J. J. Sullivan
AMERICAN COAST	John J. Albright	Wm. B. Kerr	Mathew Andrews
Catalone	North West	L. S. De Graff	Edwin N. Ohl
Mystic	North Land	Wm. M. Mills	Easton
Silvia	Loftus Cuddy	John Mitchell	H. P. McIntosh
Dominion	Joseph Sellwood	W. B. Davock	Josiah S. Munro
Rosalind	E. J. Earling	Hugh Kennedy	Jas. Corrigan
	Chas. Weston	Australia	Daniel B. Meacham

This bridge wall has now been in use in practically continuous service for four years with absolutely no cost for renewals or repairs.

Richard Piepkorn, Chief Engineer Steamer E. J. Earling: "I have not had to replace one single bar in the past two seasons."

E. H. Cottrell, Chief Engineer Steamer William M. Mills: "I have no criticisms to make. They are far superior to the old style of bridge walls and give perfect satisfaction."

John D. Riley, Chief Engineer Steamer Loftus Cuddy: "They have been in about two seasons now and are in good condition and show no signs of burning out."

Rudolph Shinsky, Chief Engineer Steamer Charles Weston: "They have given complete satisfaction in every respect. Clinkers do not adhere to them and they are always perfectly clean. They are in as good condition today as when first installed."

John Radford, Chief Engineer Steamer Australia: "They are not marred in any way, have never been out of place and are just as good as when first installed."

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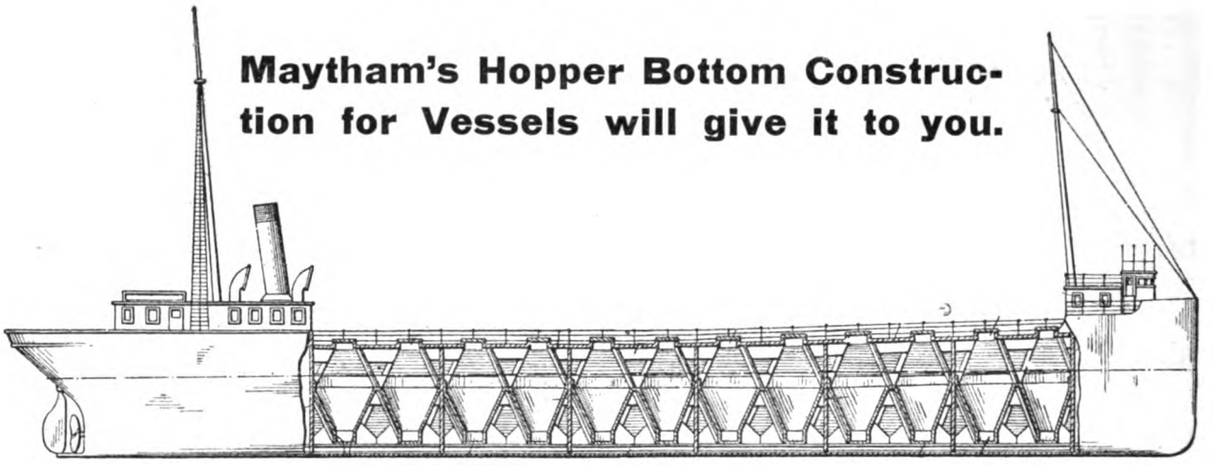
DO YOU WANT

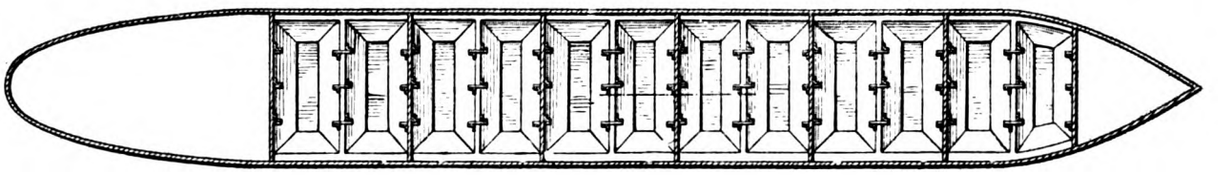
Safety--Economy--Strength

IN YOUR VESSELS?

Maytham's Hopper Bottom Construction for Vessels will give it to you.



HOPPER LAKE VESSEL: LONGITUDINAL SECTION.



HOPPER LAKE VESSEL: LOOKING DOWN UPON THE DECK.

SOME OF THE ADVANTAGES

Safety
1. Practically non-sinkable.
2. Cargo cannot shift, or get wet.
3. Boat will not break in two.

Economy
1. Lower insurance.
2. Less expense unloading.
3. Saving in time.

Strength
1. Truss construction prevents vibration.
2. Hopper frames brace hull in every direction.
3. Decks not weakened by numerous hatches.

Automatic Transfer Company

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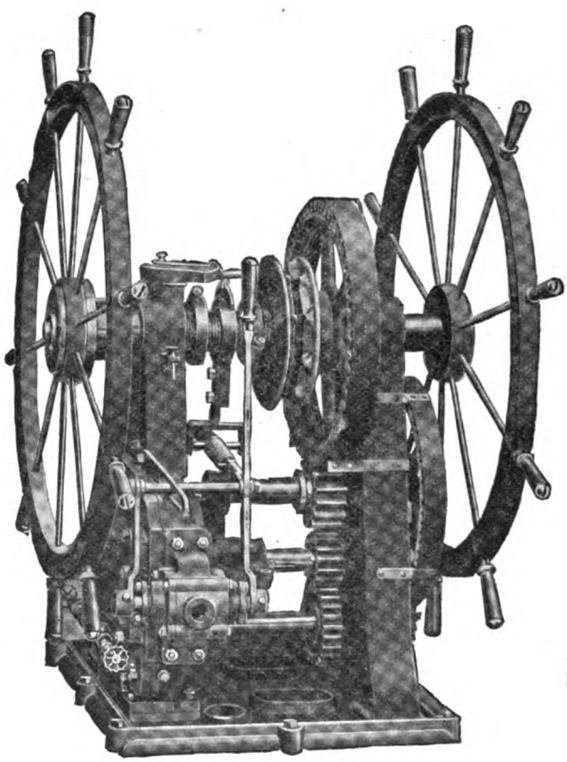
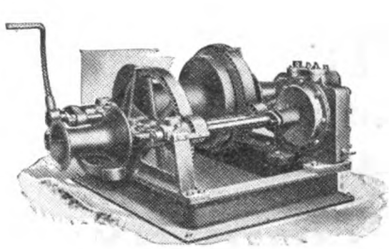
Dake Engine Co.

Grand Haven, Mich.

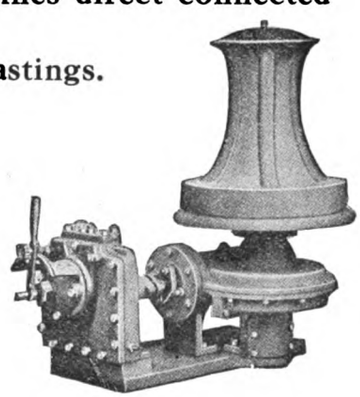


We manufacture Steering Gears, using either a single or double wheel as required. They are simple, durable and practically noiseless. Also Boiler Testing Pumps, Chain Hoists, Derrick Crabs, Swinging Gears, Capstans, Windlasses, Deck Hoists, Engines direct connected to Centrifugal Pumps and Electric Dynamos.

We make all kinds of Brass and Gray Iron Castings.



LET US KNOW YOUR NEEDS



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1886-1907 WIN THE LAUREL WREATH Sales 500,000

WHY HESITATE

On the Choice Made by 500,000 Engineers?

YOU CANNOT MAKE A MISTAKE.

Catalog No. 23 Contains Full Information.

PENBERTHY INJECTOR COMPANY,

Largest Injector Manufacturers in the World.

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BRANCHES:— { NEW YORK, N. Y. / LONDON, ENG.

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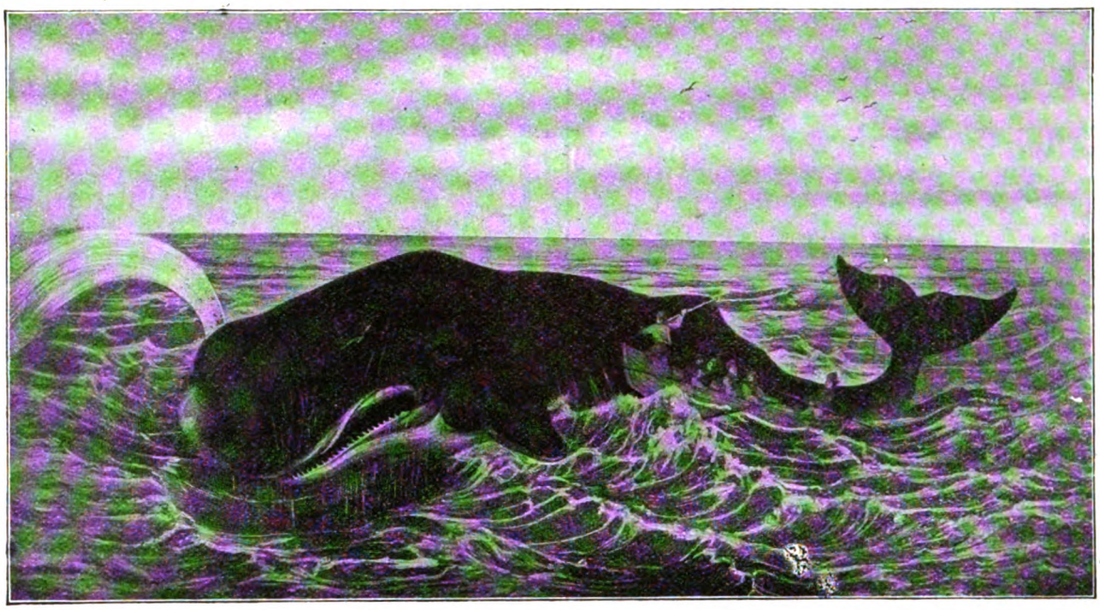
When you see our trade mark "Whale" on a valve it means that every stage of its manufacture has been safeguarded



OUR LINE OF VALVES are designed to meet the most rigid requirements demanded by the severe conditions in modern steam plants. They are all equipped with our Special Whale Brand Nickel Bronze seats and discs, the only alloy that will resist the cutting effect of superheated steam.

A sample order will illustrate better than words why we are able to guarantee them to remain tight.

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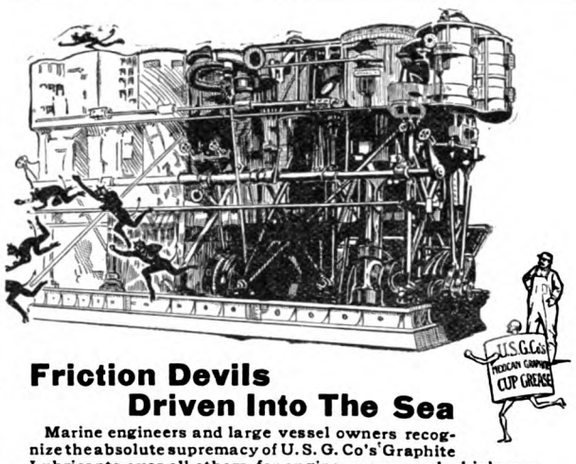

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U. S. G. Co's No. 205 Lubricating Graphite

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The former is a pure, soft graphite *powder*—not "flake" but air-floated and gritless very adhesive and working at all temperatures and under all frictional pressures. Mixes readily with oil and remains suspended therein sufficiently long to feed through lubricator tubes without clogging.

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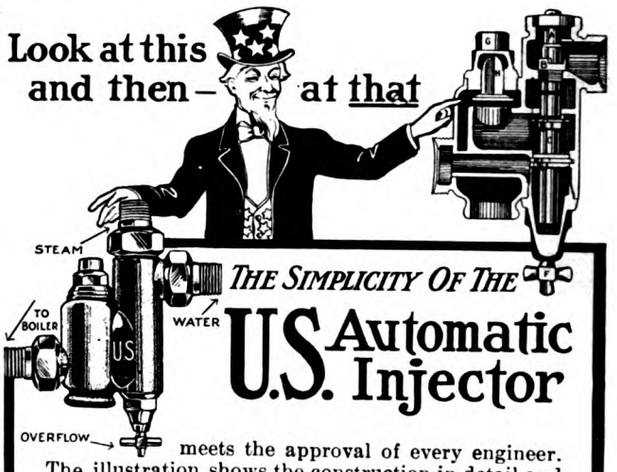

THE SIMPLICITY OF THE

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meets the approval of every engineer. The illustration shows the construction in detail and is most convincing evidence why it meets the needs of the steam user better than any other. Every part is accessible and easily cleaned. All parts are interchangeable. Duplicate parts can be quickly furnished and put in by the user.

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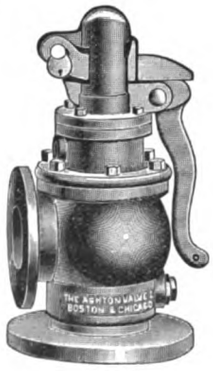

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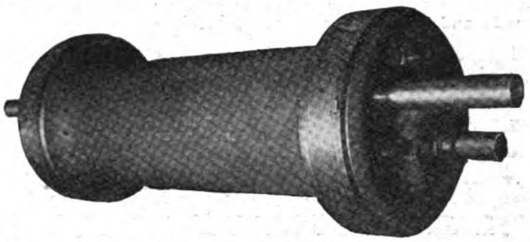

With a record of 91,341 miles without cost and in perfect condition. Frictional contact of the rings against the Valve Chamber, AUTOMATICALLY regulated. Combined advantages of the Plug and Snap-ring Valves without the drawbacks of either. Wears the Valve Chamber TRUE. Guaranteed for pressure up to 750 pounds.

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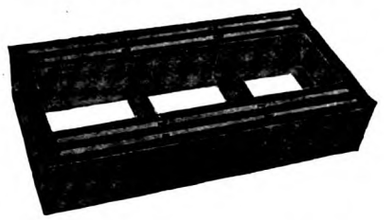

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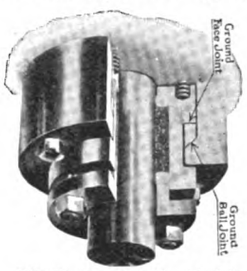

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For Steam, Water, Air, Gas, Hydraulic Machines, Valves, Etc.

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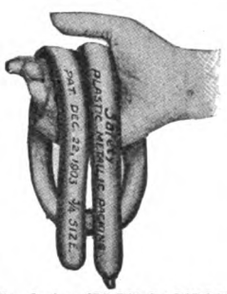

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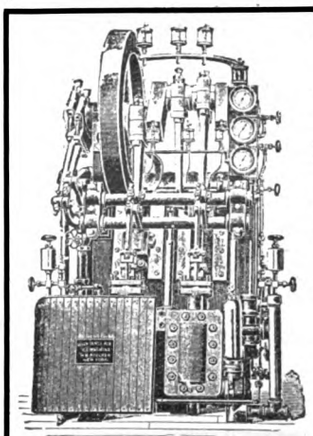


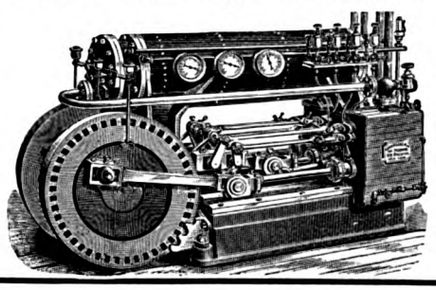
The ALLEN Dense Air Ice Machine

Contains no chemicals; only air at 65 lbs. pressure in pipes.

It is placed in the engine room and attended by the regular engineers, while ice-making box, meatroom and galley and pantry refrigerators are at the usual distant places. Proven by many years' service in the tropics on U. S. men of war, steam yachts and passenger steamers.

MORE THAN 150 IN DAILY SERVICE ON STEAM VESSELS

It is as noiseless as any steam engine.



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SPENCE MANUFACTURING CO.

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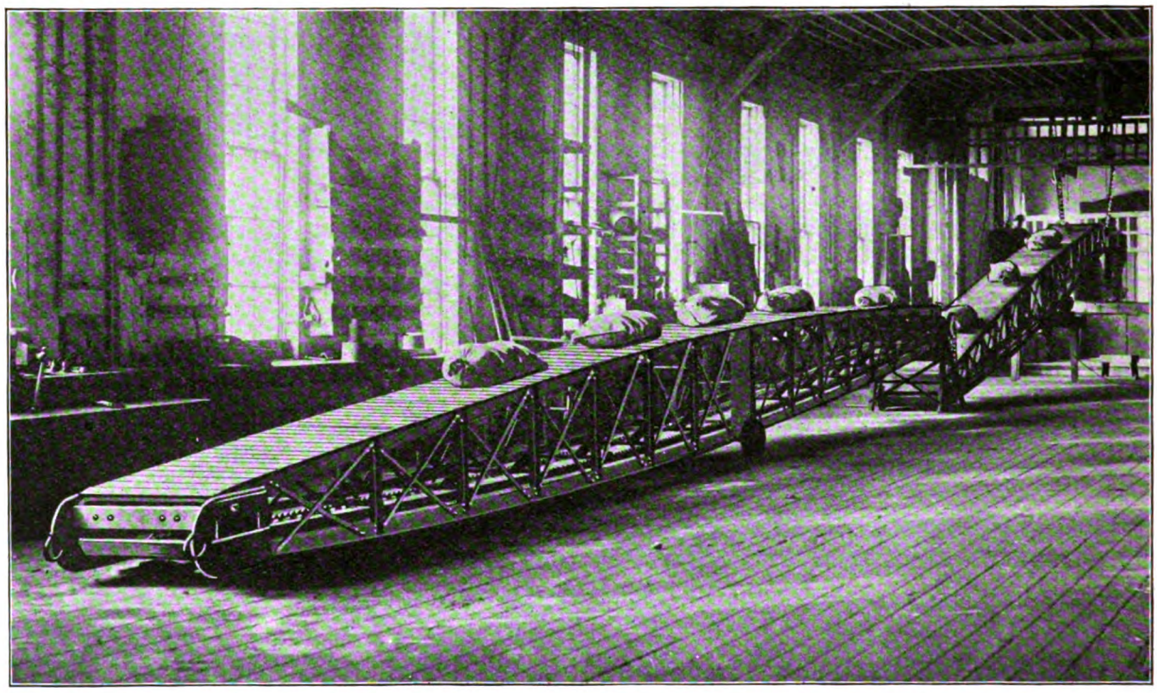
Spence, Electric, Portable Conveyors

(Patented in United States, Canada and England)



These Spence Conveyors are used by the Federal Sugar Refining Co., Yonkers, N. Y., for carrying 350 lb. sacks of raw sugar from vessels to hoppers in the refinery.

We manufacture conveyors (power and gravity) for carrying Boxes, Barrels, Sacks and all classes of freight.

The Cunard Steamship Co., New York, have bought and will use three of our Conveyors to load the "Mauretania" and "Lusitania" commencing in January.

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SPENCE MFG. CO.

Inventors and Exclusive Manufacturers **ST. PAUL, MINN.**

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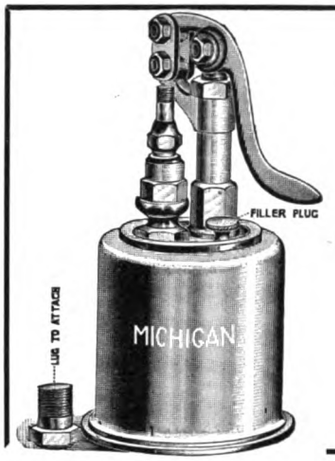
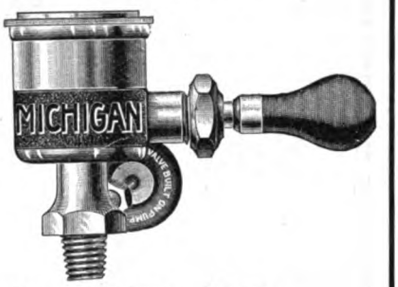


Michigan Oil Pumps

for Marine use



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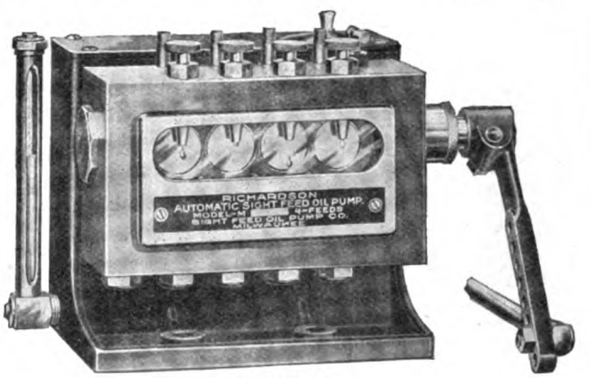
THE RICHARDSON Automatic Oil Pump



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A neat, new design of positive sight feed oil pump, supplied with case-hardened, regrinding checks and patented metallic packing. The details of construction and price will interest you.

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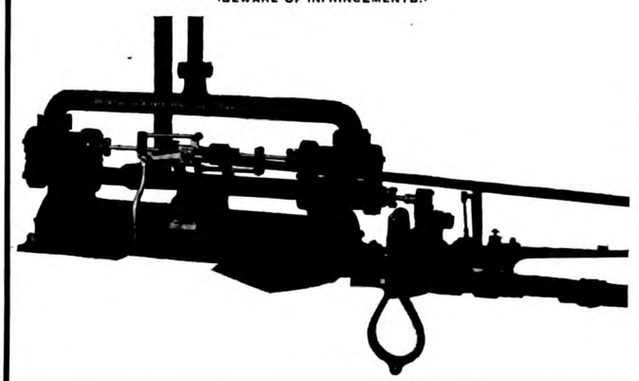

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WE HAVE Special Machinery, Large Experience, producing a SUPERIOR ENGINE for least amount of money.
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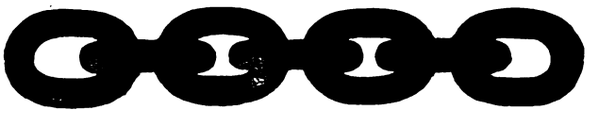

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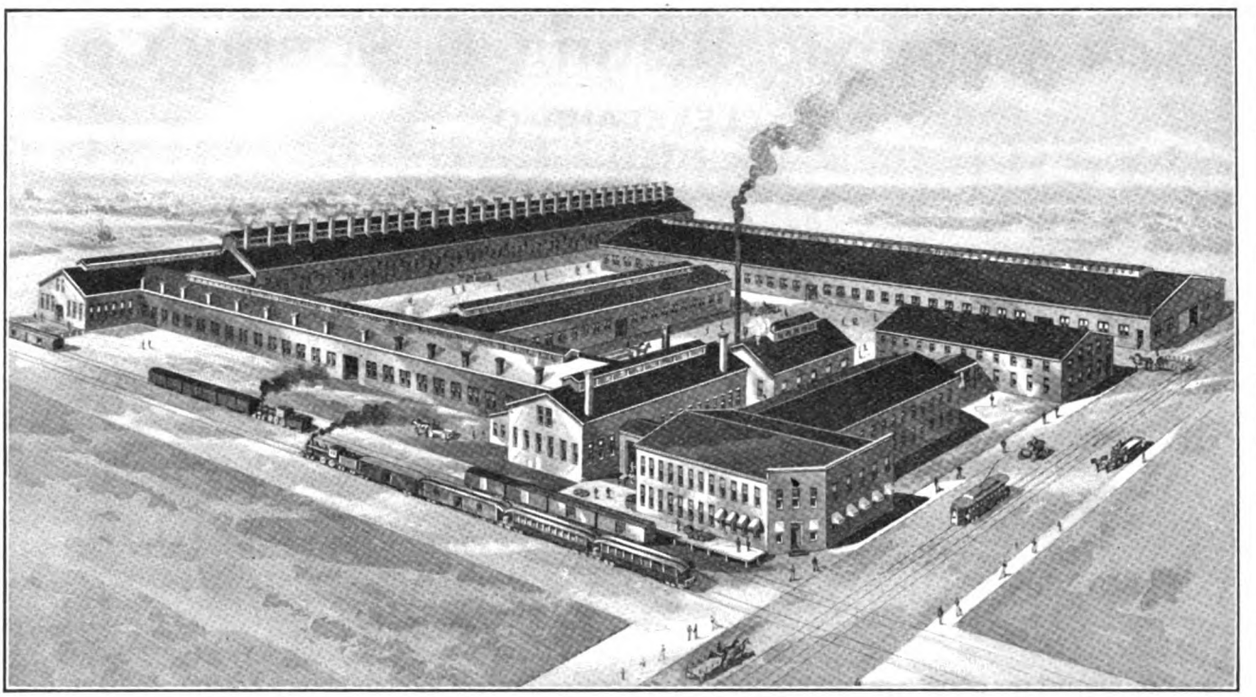

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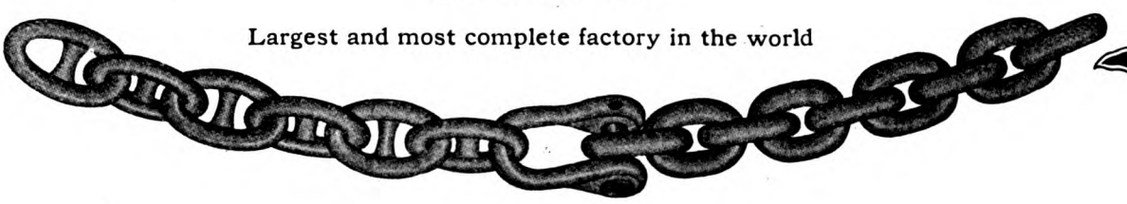

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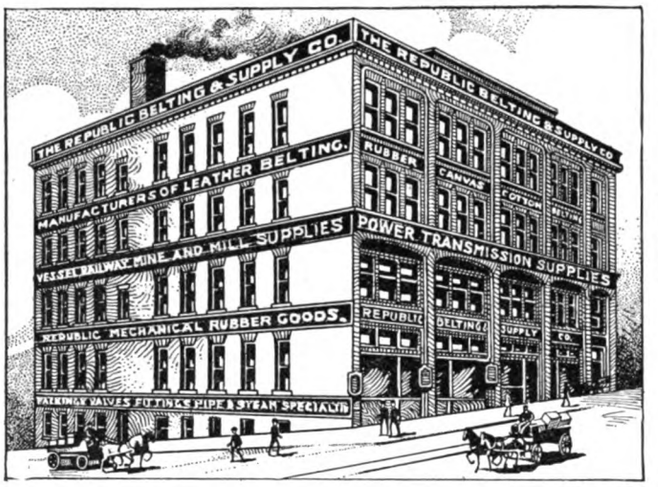
For Vessels, Docks or Mines.



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In 27 years not a single loss of life through defects in quality or workmanship.

CHAIN AND FORGINGS OF ALL KINDS

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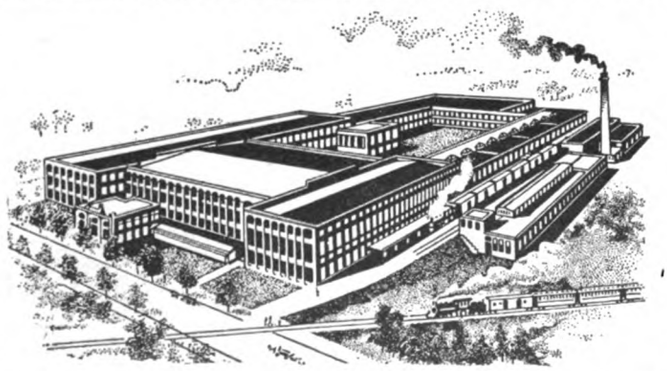

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"CYCLONE"

HIGH-SPEED CHAIN HOIST

With Self-Lubricating Bearings

High Efficiency **High Speed** **Great Durability** **All Gears Cut**

3 tons and larger sizes made as above.

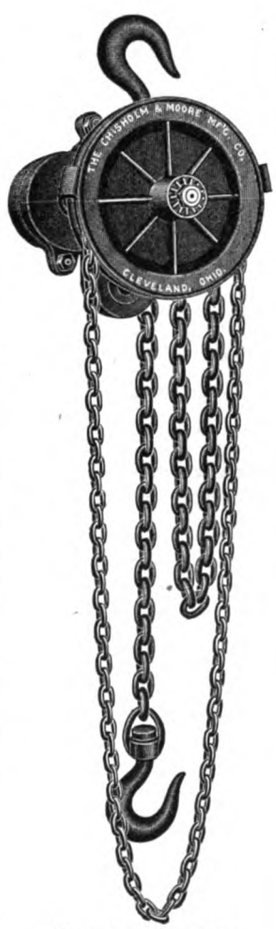
THE lift wheel, Fig. 1, that is the sprocket wheel which carries the lift chain, is cast in one piece with the spur wheel that drives it. This double wheel turns freely upon a hollow shaft rigidly supported at both ends in the frame. The spur wheel is encircled by a yoke having internal teeth meshing into the spur wheel teeth and driven with a gyrating movement into the spur wheel placed diametrically opposite. See Fig. 2. The hand wheel shaft passes through the hollow main shaft carrying at the further end a pinion which drives two spur wheels, one on each of the two eccentric shafts. See Fig. 3.

Fig. 1.

The number of the teeth in the spur wheel divided by the difference between the number of the spur wheel teeth and the number of the internal teeth of the yoke equals the number of revolutions of the eccentric necessary to turn the lift wheel once. (In the one-ton size, the spur wheel has twenty-one teeth, the yoke twenty-four internal teeth, and the eccentrics turn seven times to each revolution of the lift wheel.) The teeth are cut with accuracy and work smoothly together. There are a number of them in contact, insuring great strength. The eccentric shafts have bearings at both ends and roller bushed connection with the yoke. All bearings have self-lubricating **Graphite Bronze Bushings.** There are no overhanging bearings in the Hoist, so that under the full load the frame will not spring and bind the working parts. The extreme simplicity and great strength of this construction is apparent. It is as practicable for the twenty-ton size as for the half-ton without undue increase in size or weight.

The friction loss of this movement is so slight (**the efficiency is about eighty per cent,**) that it has been found practicable to gear the Hoists to a very high speed, higher than that of any other Hoists yet manufactured, without increasing the hand wheel pull above that of other slower hoists.

The automatic brake permits the spinning of the hand wheel in either direction when there is no load, locks the load with perfect safety, and yet permits its free lowering by a very slight reverse pull on the hand chain.



½ ton and 1 ton sizes made as above.

Fig. 2.

Send for Complete Illustrated Catalogue of Hoists and Trolleys.

THE CHISHOLM & MOORE MFG. CO.

CLEVELAND, OHIO

Fig. 3.

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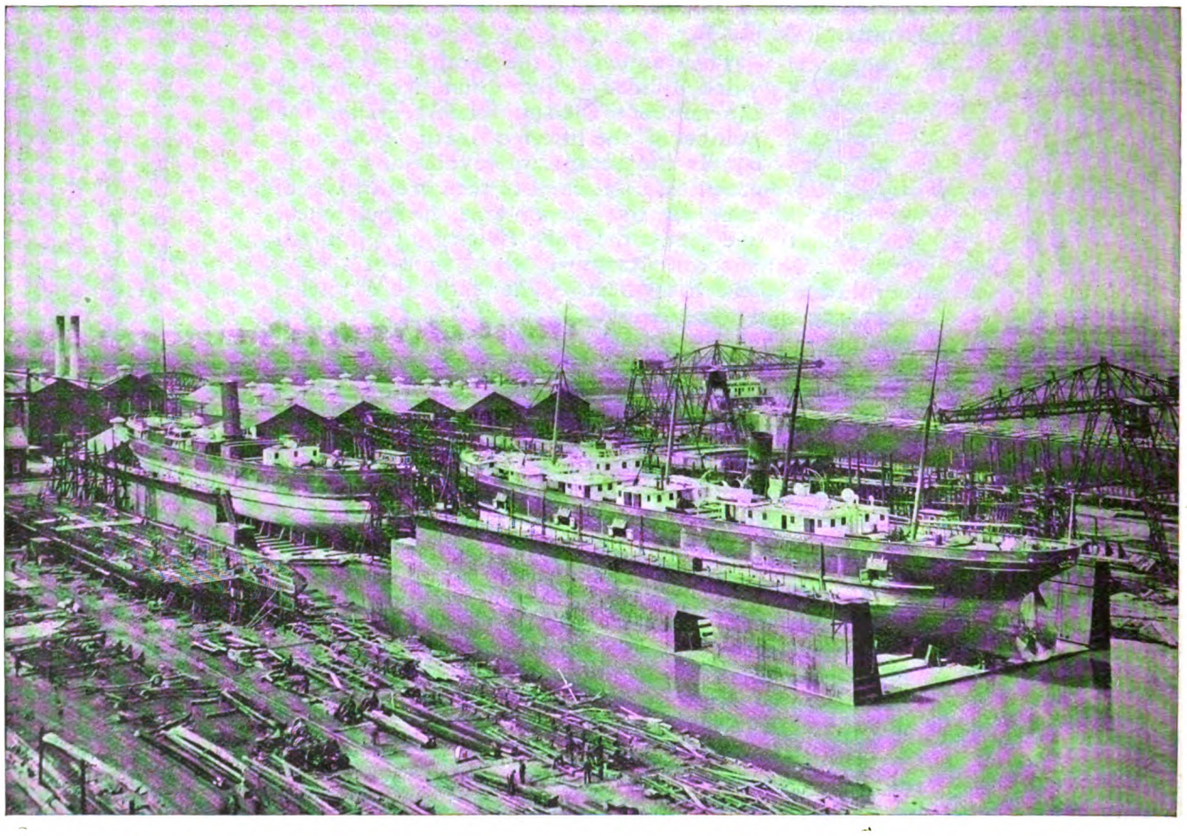

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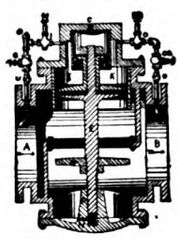

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Manistee, Mich.

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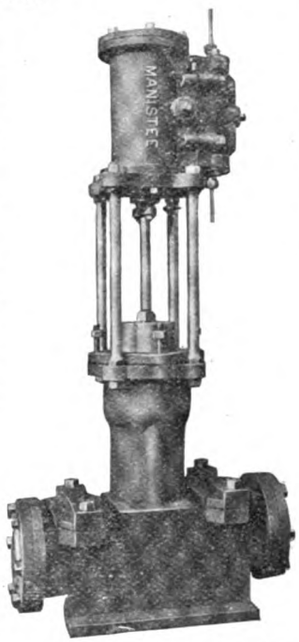


This photograph of the "MANISTEE" Upright Bilge Pump shows the 6-inch x 6-inch x 10-inch stroke pump. We make these pumps either upright or horizontal, in either of the following sizes:

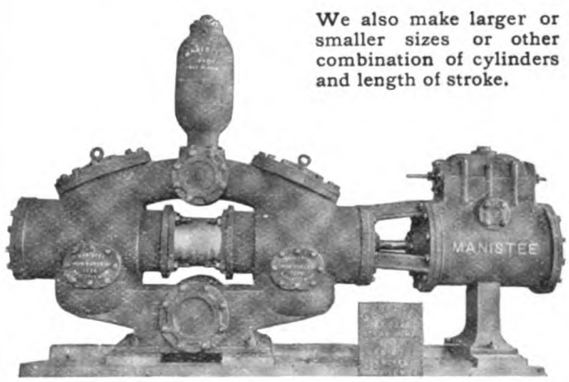
4″ x 4″ x 6″
5″ x 5 x 8″
6″ x 6″ x 10″
8″ x 8″ x 12″
10″ x 10″ x 12″
12″ x 12″ x 12″

We also make larger sizes and other combination of cylinders or longer stroke to suit special requirements and floor space. They can also be made at any angle to fit on skin of boat if required.

This photograph of the "MANISTEE" Centrally Packed Plunger Pump shows the 18-inch x 12-inch x 24-inch pump. We make these pumps in the following sizes:

4″ x 2⅜″ x 5″
5″ x 3 ″ x 6″
6″ x 3⅝″ x 8″
7″ x 4 ″ x 8″
8″ x 5 ″ x 10″
10″ x 6 ″ x 12″
12″ x 7¼″ x 12″
14″ x 8″ x 12″
16″ x 10″ x 18″
18″ x 12″ x 24″
20″ x 14″ x 24″
24″ x 16″ x 24″
30″ x 18″ x 24″

We also make larger or smaller sizes or other combination of cylinders and length of stroke.



All of our pumps can be made with compound cylinders, if required.

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Buyers' Directory of the Marine Trade---*Continued.*

HOLLOW STAYBOLT IRON OR STEEL BARS.

Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

HYDRAULIC TOOLS.

Watson-Stillman Co., The.....New York.

ICE MACHINERY.

Great Lakes Engineering Works....Detroit.
Roelker, H. B.....New York.

INJECTORS.

American Injector Co.....Detroit.
Jenkins Bros.....New York.
Penberthy Injector Co.....Detroit, Mich.

INSURANCE, MARINE.

Belcher, Fred P.....Winnipeg.
Brown & Co.....Buffalo, N. Y.
Elphicke, C. W. & Co.....Chicago.
Gilchrist & Co., C. P.....Cleveland.
Hawgood & Co., W. A....Cleveland.
Helm & Co., D. T.....Duluth.
Hutchinson & Co.....Cleveland.
McCarthy, T. R.....Montreal.
McCurdy, Geo. L.....Chicago.
Mehl, Edward.....Erie, Pa.
Mitchell & Co.....Cleveland.
O'Connor, J. J.....Port Arthur, Ont.
Parker Bros. Co., Ltd.....Detroit.
Prindiville & Co.....Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.
Vance & Joys Co.....Milwaukee.
Willcox, Peck & Hughes.....New York and Chicago.

IRON ORE AND PIG IRON.

Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co....Cleveland.

KEEL BLOCKS, WEDGE.

Keymer Mfg. Co.....Cleveland.

LAUNCHES—STEAM, NAPHTHA, ELECTRIC.

Truscott Boat Mfg. Co.....St. Joseph, Mich.

LIFE PRESERVERS, LIFE BOATS, BUOYS.

Armstrong Cork Co.....Pittsburg.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's, David, Sons.....New York.

LOGS.

Nicholson Ship Log Co...Cleveland.
Walker & Sons, Thomas.....Birmingham, Eng.

LUBRICATING GRAPHITE.

Dixon Crucible Co., Joseph.....Jersey City, N. J.
U. S. Graphite Co....Saginaw, Mich.

LUBRICATORS.

Penberthy Injector Co.....Detroit, Mich.
Republic Belting & Supply Co.....Cleveland.

LUMBER.

Martin-Barriss Co.....Cleveland.

MACHINISTS.

Chase Machine Co.....Cleveland.
Lockwood Mfg. Co.....East Boston, Mass.
McKinnon Iron Works, Ashtabula, O.
Superior Iron Works.....Superior, Wis.

MACHINE TOOLS (WOOD WORKING).

Atlantic Works, Inc....Philadelphia.

MARINE MODELS.

The H. E. Boucher Co.....New York City.

MARINE MACHINERY—STEAM.

Marine Iron Wks.....Chicago, Ill.

MATTRESSES, CUSHIONS, BEDDING.

Fogg, M. W.....New York.

MECHANICAL DRAFT FOR BOILERS

American Ship Building Co.....Cleveland.
Detroit Ship Building Co....Detroit.
Great Lakes Engineering Works....Detroit.

METALLIC PACKING.

Unique Engineering Co.....Brooklyn, N. Y.
Katzenstein, L. & Co.....New York.
Republic Belting & Supply Co.....Cleveland.

MOTORS, GENERATORS—ELECTRIC.

General Electric Co.....Schenectady, N. Y.

NAUTICAL INSTRUMENTS.

Ritchie, E. S. & Sons.....Brookline, Mass.

NAVAL ARCHITECTS.

Babcock & Penton.....Cleveland.
Curr, Robert.....Cleveland.
Hynd, Alexander.....Cleveland.
Kidd, Joseph.....Duluth, Minn.
Nacey, James.....Cleveland.
Wilby, Carlton.....Detroit, Mich.
Wood, W. J.....Chicago.

OAKUM.

Baltimore & Oakum Works.....Baltimore.
Stratford Oakum Co.....Jersey City, N. J.

OIL AND GREASE CUPS.

Penberthy Injector Co.....Dertoit, Mich.

OILS AND LUBRICANTS.

Dixon Crucible Co., Joseph.....Jersey City, N. J.
Monitor Oil Co.....Cleveland.
U. S. Graphite Co...Saginaw, Mich.

OIL PUMPS.

Sight Feed Oil Pump Co.....Milwaukee, Wis.

PACKING.

Jenkins Bros.....New York.
Katzenstein, L. & Co....New York.
Republic Belting & Supply Co.....Cleveland.
Steel Mill Packing Company.....Detroit, Mich.

PADDLE-WHEEL BOAT MACHINERY.

Marine Iron Wks.....Chicago, Ill.

PAINTS AND VARNISHES.

Baker, Howard H. & Co.....Buffalo.
Billings-Chapin Co. .....Cleveland.
Hardy Paint & Varnish Co.....Toledo, O.
Hascall Paint Co.....Cleveland.
Standard Varnish Works..New York.
Upson-Walton Co.....Cleveland.
U. S. Graphite Co....Saginaw, Mich.

PILE DRIVING AND SUBMARINE WORK.

Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co....Buffalo.
Great Lakes Dredge & Dock Co....Chicago.
Parker Bros. Co., Ltd.....Detroit.
Starke Dredge & Dock Co., C. H...Milwaukee.
Sullivan, M.....Buffalo.

PIPE COVERING.

Standard Pipe Covering Co.....Cleveland.

PIPE CUTTING AND THREADING MACHINES.

The Armstrong Mfg. Co.....Bridgeport, Conn.

PIPE, WROUGHT IRON.

Republic Belting & Supply Co.....Cleveland.

PLATES—SHIP, STRUCTURAL, ETC.

Otis Steel Co.....Cleveland.

POLISHES.

Bell Mfg. Co.....St. Louis, Mo.
Harvey Chemical Co.....LaFayette, Ind.
Hoffman, Geo. W., Indianapolis, Ind.

PRESSURE REGULATORS.

Ross Valve Mfg. Co....Troy, N. Y.

PROPELLER WHEELS.

American Ship Building Co.....Cleveland.
Atlantic Works..East Boston, Mass.
Cramp, Wm. & Sons....Philadelphia.
Detroit Ship Building Co....Detroit.
Fore River Ship Building Co.....Quincy, Mass.
Great Lakes Engineering Works....Detroit.
Hyde Windlass Co.....Bath, Me.
Lockwood Mfg. Co.....East Boston, Mass.
Marine Iron Wks.....Chicago.
Milwaukee Dry Dock Co.....Milwaukee.
Newport News Ship Building Co....Newport News, Va.
Roelker, H. B.....New York.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co.....Superior, Wis.
Toledo Ship Building Co.....Toledo.
Trout, H. G.....Buffalo.

PROJECTORS, ELECTRIC.

General Electric Co.....Schenectady, N. Y.

PUMPS FOR VARIOUS PURPOSES.

Great Lakes Engineering Works....Detroit.

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Kingsford Foundry & Machine Works .....Oswego, N. Y.
Manistee Iron Works Co.....
.....Manistee, Mich.
Marine Iron Works.....Chicago.
Wheeler Condenser & Engineering Co. .....New York.
Williams Gauge Co.....Pittsburg.
Roelker, H. B.....New York.

REGISTER FOR CLASSIFICATION OF VESSELS.

Great Lakes Register.....Cleveland.

RIVETS, STEEL FOR SHIPS AND BOILERS.

Champion Rivet Co.....Cleveland.
Great Lakes Engineering Works....
.....Detroit.

RUBBER GOODS.

Republic Belting & Supply Co.....
.....Cleveland.

SAIL MAKERS.

Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.

SALVAGE COMPANIES.

See Wrecking Companies.

SEARCH LIGHTS.

General Electric Co.....
.....Schenectady, N. Y.

SEPARATORS.

Rogers Oil Separator Co.....Buffalo.

SHEARS.

See Punches and Shears.

SHIP AND BOILER PLATES AND SHAPES.

Otis Steel Co.....Cleveland.

SHIP BUILDERS.

American Ship Building Co.....
.....Cleveland.
Atlantic Works...East Boston, Mass.
Buffalo Dry Dock Co.....Buffalo.
Collingwood Shipbuilding Co.....
.....Collingwood, Ont.
Cramp, Wm. & Sons....Philadelphia.
Chicago Ship Building Co...Chicago.
Detroit Ship Building Co....Detroit.
Empire Ship Building Co....Buffalo.
Fore River Ship Building Co.....
.....Quincy, Mass.
Great Lakes Engineering Works....
.....Detroit.
Lockwood Mfg. Co.....
....East Boston, Mass.
Manitowoc Dry Dock Co.....
.....Manitowoc, Wis.
Maryland Steel Co.....
.....Sparrow's Point, Md.
Milwaukee Dry dock Co.....
..... Milwaukee.
Newport News Ship Building Co....
.....Newport News, Va.
New York Shipbuilding Co.....
.....Camden, N. J.
Port Huron Construction Co.....
.....Port Huron, Mich.
Toledo Ship Building Co.....Toledo.

SHIP CEMENT.

Hardy Paint & Varnish Co.....
.....Toledo, O.

SHIP CHANDLERS.

Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.

SHIP DESIGNERS.

Kidd, Joseph .....Duluth.
Nacey & Hynd.....Cleveland.
Wood, W. J.....Chicago.

SHIP FLOORING.

American Sawdolet Co....Cleveland.

SHIP LANTERNS AND LAMPS.

Upson-Walton Co.....Cleveland.

SHIP TIMBER.

Martin-Bariss Co.....Cleveland.

SHOES.

Emerson Shoe Co.....Cleveland.

SIGNALS—SUBMARINE.

Submarine Signal Co.....Boston.

SMOOTH-ON COMPOUND, FOR REPAIRS.

Smooth-On Mfg. Co.....
.....Jersey City, N. J.

STAYBOLT IRON OR STEEL BARS, HOLLOW OR SOLID.

Falls Hollow Staybolt Co.....
.....Cuyahoga Falls, O.

STEAM VESSELS FOR SALE.

Holmes, Samuel.....New York.
McCarthy, T. R.....Montreal, Can.

STEAMSHIP LINES, PASS. AND FREIGHT.

American Line.....New York.
Boston Steamship.....Boston.
Cleveland & Buffalo Transit Co.....
.....Cleveland.
International Mercantile Marine Co.
.....Philadelphia.
Mallory Line.....New York.
Red Star Line.....New York.

STEEL.

Scully Steel & Iron Co...Chicago.

STEEL CASTINGS.

Otis Steel Co.....Cleveland.

STEERING APPARATUS.

American Ship Building Co.....
.....Cleveland.
Chase Machine Co.....Cleveland.
Dake Engine Co.....
.....Grand Haven, Mich.
Detroit Ship Building Co...Detroit.
Hyde Windlass Co.....Bath, Me.
Marine Iron Wks.....Chicago.
Sheriffs Mfg. Co.....Milwaukee.

STOKERS.

Underfeed Stoker Co. of America..
.....Chicago.

SUBMARINE DIVING APPARATUS.

Morse & Son, A. J.....Boston.
Schrader's Son, Inc. A....New York.

SUPPLIES.

Port Huron Construction Co.....
.....Port Huron, Mich.

SURVEYORS, MARINE.

Curr, Robert .....Cleveland
Parker Bros. Co., Ltd.....Detroit.
Nacey, James.....Cleveland.
Wood, W. J.....Chicago.

TESTS OF MATERIALS.

Hunt, Robert W. & Co.....Chicago.

THERMIT.

Goldschmit Thermit Co.....
.....New York City.

THREAD CUTTING TOOLS.

Armstrong Manufacturing Co.....
.....Bridgeport, Conn.

TILING, RUBBER.

Republic Belting & Supply Co.....
.....Cleveland.

TOOLS.

Republic Belting & Supply Co.....
.....Cleveland.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.

Watson-Stillman Co.....New York.

TOOLS, WOOD WORKING.

Atlantic Works, Inc....Philadelphia.

TOWING MACHINES.

American Ship Windlass Co.....
..... Providence, R. I.
Chase Machine Co.....Cleveland.

TOWING COMPANIES.

Donnelly Salvage & Wrecking Co..
.....Kingston, Ont.
Great Lakes Towing Co...Cleveland.

TRUCKS.

Boston & Lockport Block Co.....
..... Boston, Mass.

TUBING, SEAMLESS.

Shelby Steel Tube Co..Pittsburg, Pa.

TUGS.

Port Huron Construction Co.....
.....Port Huron, Mich.

VALVES, STEAM SPECIALTIES, ETC.

Jenkins Bros.....New York.
New Bedford Boiler & Machine Co.
.....New Bedford, Mass.
Penberthy Injector Co.....
Hynd, Alexander.....Cleveland.
.....Detroit.
Republic Belting & Supply Co.....
.....Cleveland.
Ross Valve Co.....Troy, N. Y.

VALVES FOR WATER AND GAS.

American Balance Valve Co.....
.....Jersey Shore, Pa.
Ashton Valve Co.....Boston.
Republic Belting & Supply Co.....
.....Cleveland.
Ross Valve Mfg. Co....Troy, N. Y.
Scoville Check Valve Co.....
.....Ashtabula, O.

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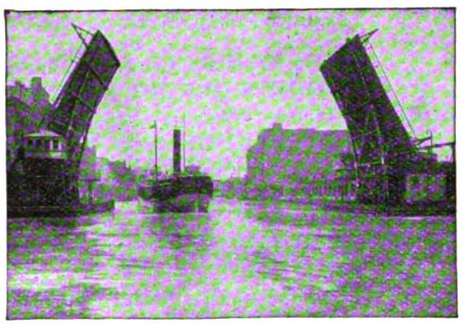

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World's Fair, St. Louis, 1904

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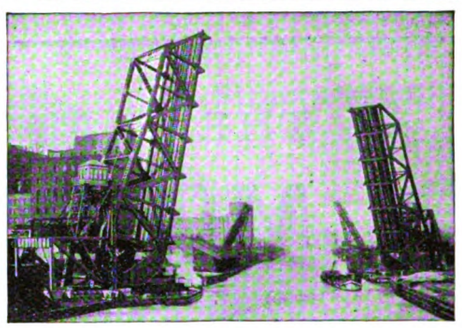

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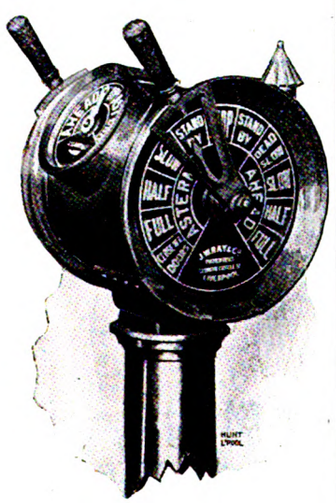

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VESSEL AND FREIGHT AGENTS.

Boland, John J.....Buffalo.
Douglas, G. L. Jr.....Duluth.
Elphicke, C. W. & Co.....Chicago.
Hall, John B.....Buffalo.
Helm & Co., D. T.....Duluth.
Hawgood & Co., W. A....Cleveland.
Holmes, Samuel.....New York.
Hutchinson & Co.....Cleveland.
McCarthy, T. R.....Montreal.
Mehl, Edward.....Erie, Pa.
Mitchell & Co.....Cleveland.
O'Connor, J. J....Port Arthur, Ont.
Parker Bros. Co., Ltd.....Detroit.
Prindiville & Co.....Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.
Vance & Joys Co.....Milwaukee

WATER GAGES.

Penberthy Injector Co.....
.....Detroit Mich.

Republic Belting & Supply Co.....
.....Cleveland.

WHITE LEAD.

Hardy Paint & Varnish Co.....
.....Toledo, O.

WILFORD'S WATERPROOF CLOTH.

Bunker, E. A.....New York.

WIRE ROPE AND WIRE ROPE FITTINGS.

Baker, H. H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.

WINDLASSES.

American Ship Windlass Co.....
..... Providence, R. I.
American Ship Building Co.....
.....Cleveland.
Dake Engine Co.....
.....Grand Haven, Mich.
Hyde Windlass Co.....Bath, Me.

WINCHES.

American Ship Windlass Co.....
..... Providence, R. I.
Hyde Windlass Co.....Bath, Me.

WOOD WORKING MACHINERY.

Crescent Machine Co...Leetonia, O.

WRECKING AND SALVAGE COMPANIES.

Donnelly Salvage & Wrecking Co.,
.....Kingston, Ont.
Great Lakes Towing Co...Cleveland.
Parker Bros. Co., Ltd.....Detroit.

YACHT AND BOAT BUILDERS.

Drein, Thos. & Son.....
.....Wilmington, Del.
Truscott Boat Mfg. Co.....
.....St. Joseph, Mich.

YAWLS.

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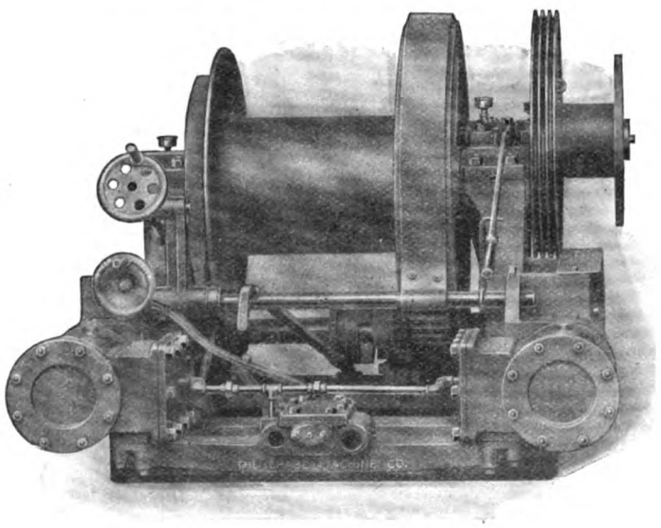

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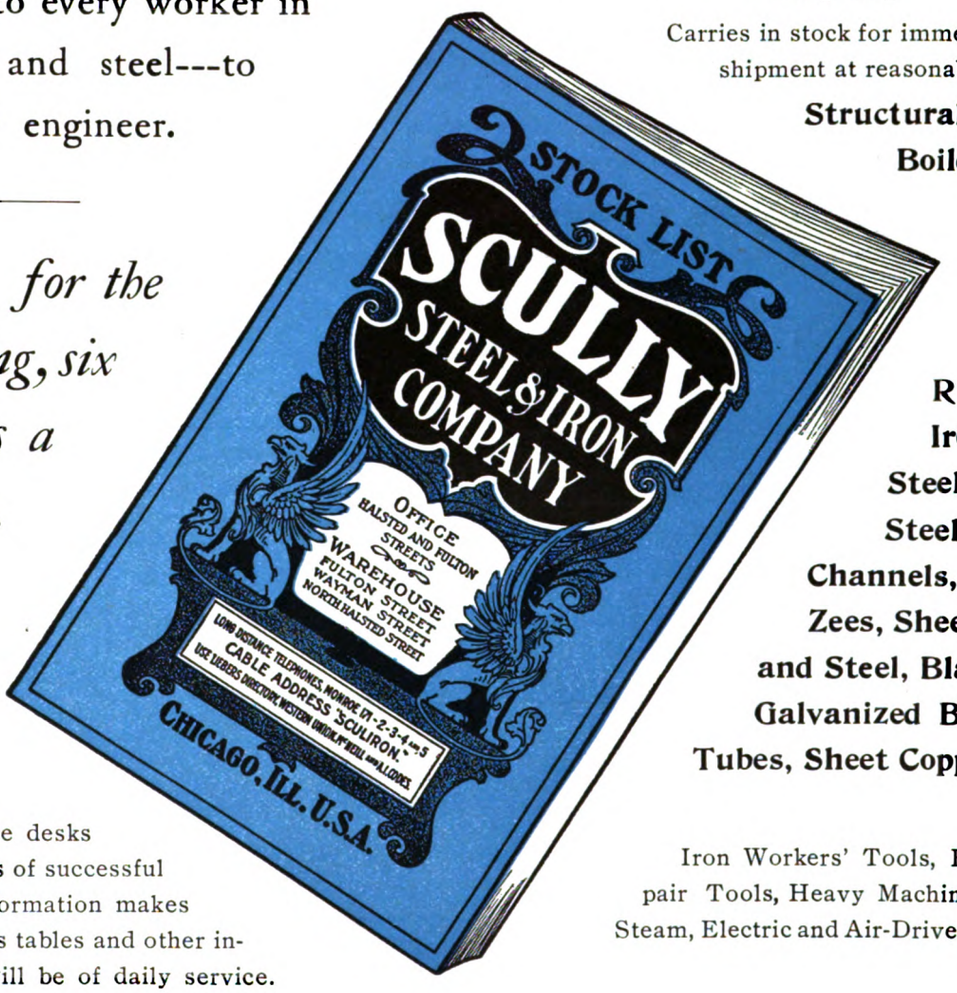

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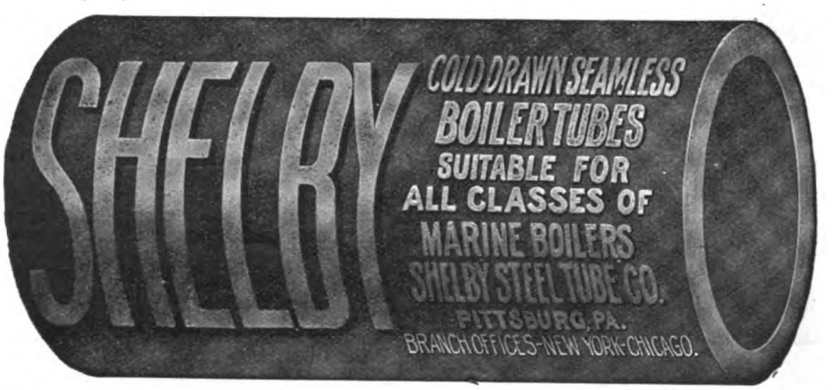

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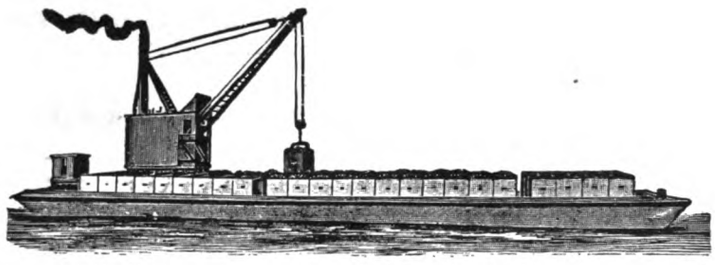

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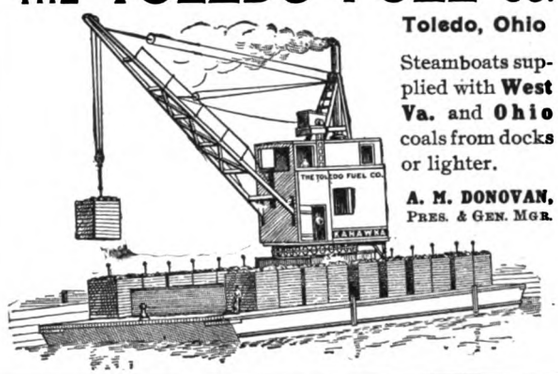

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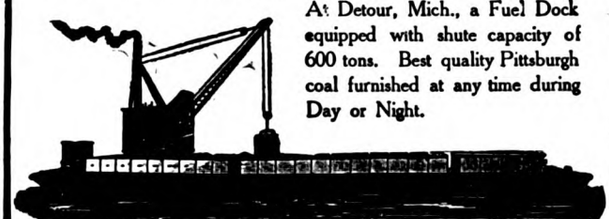

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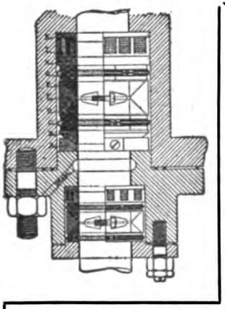

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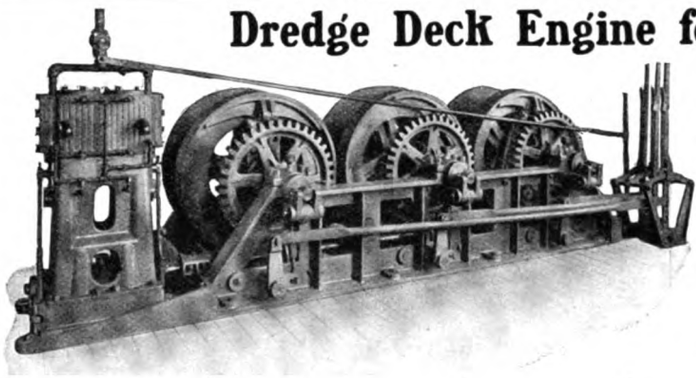

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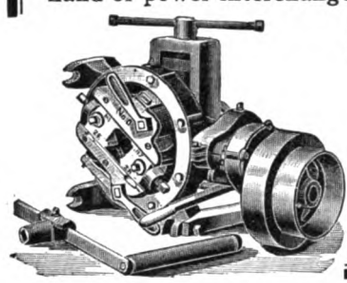

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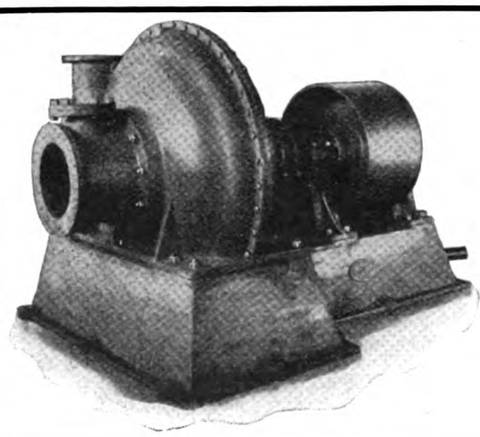

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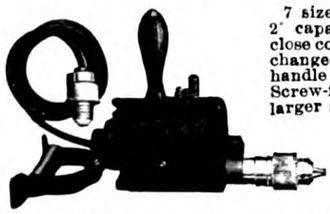

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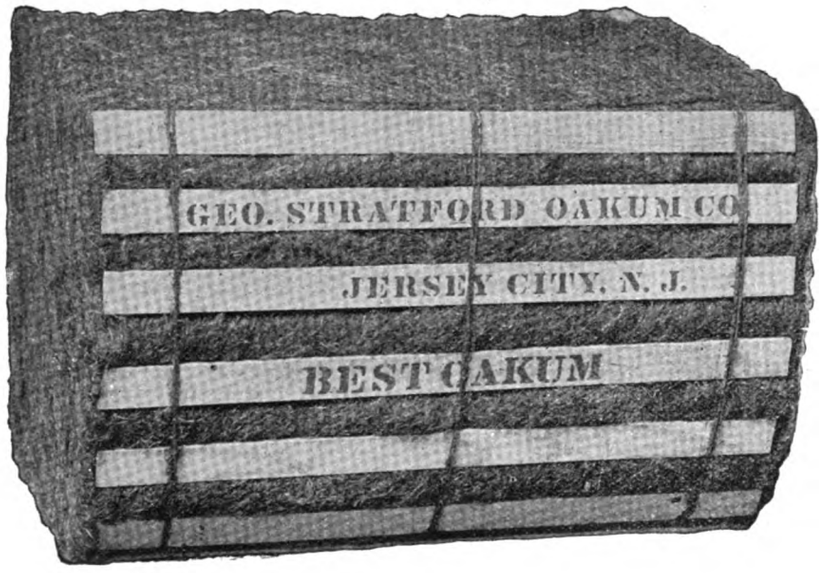

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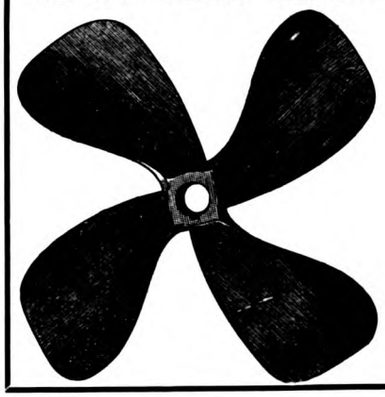

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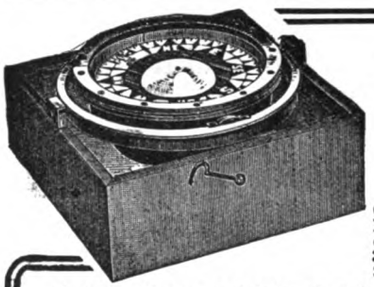

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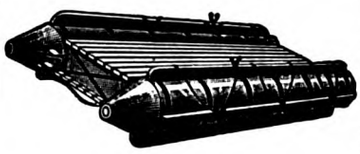
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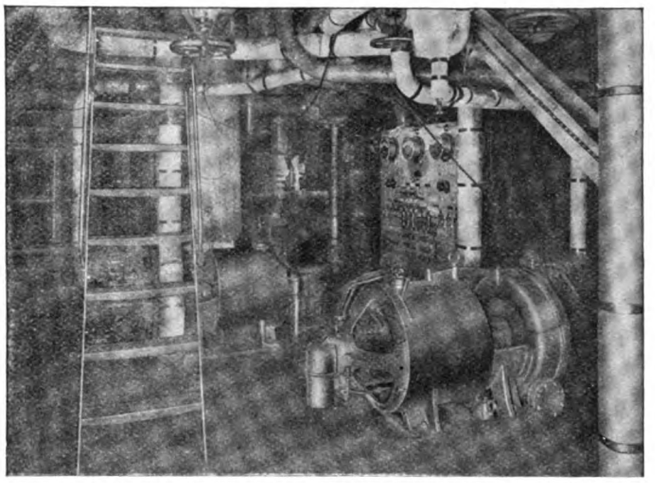

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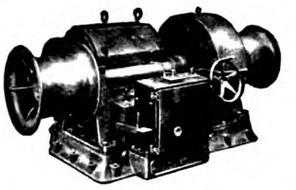

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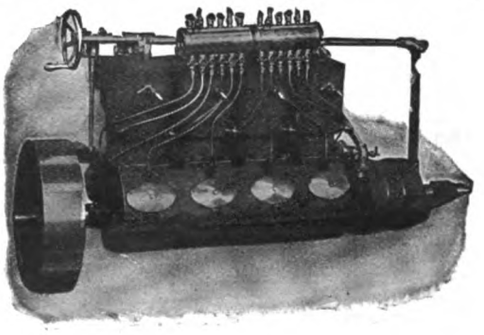

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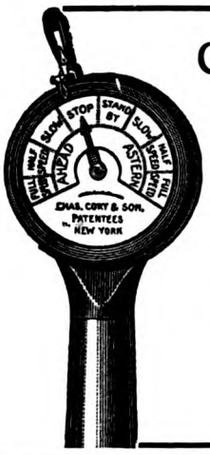

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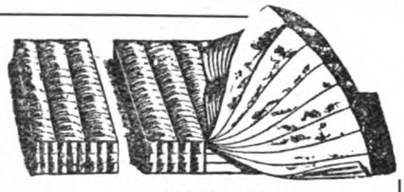

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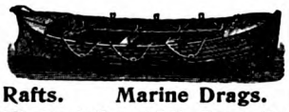

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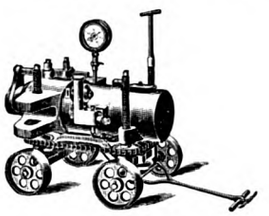

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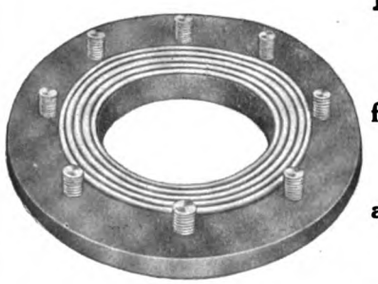

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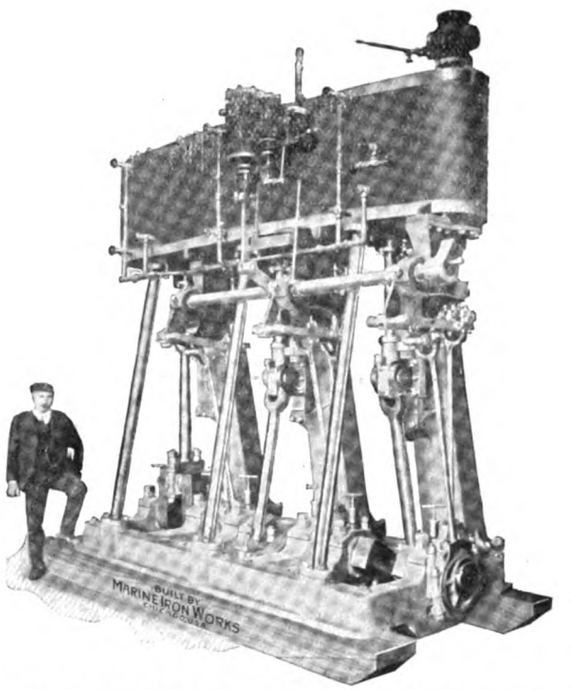

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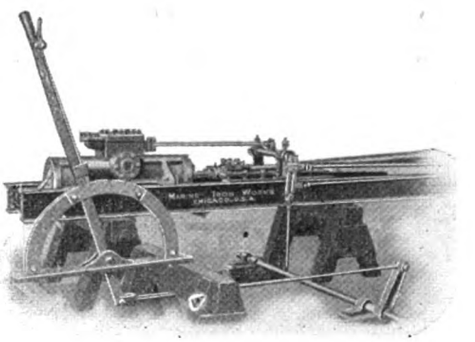

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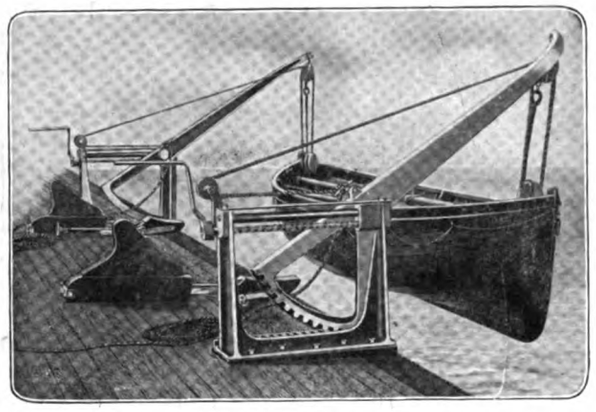

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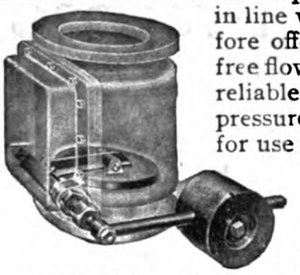

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